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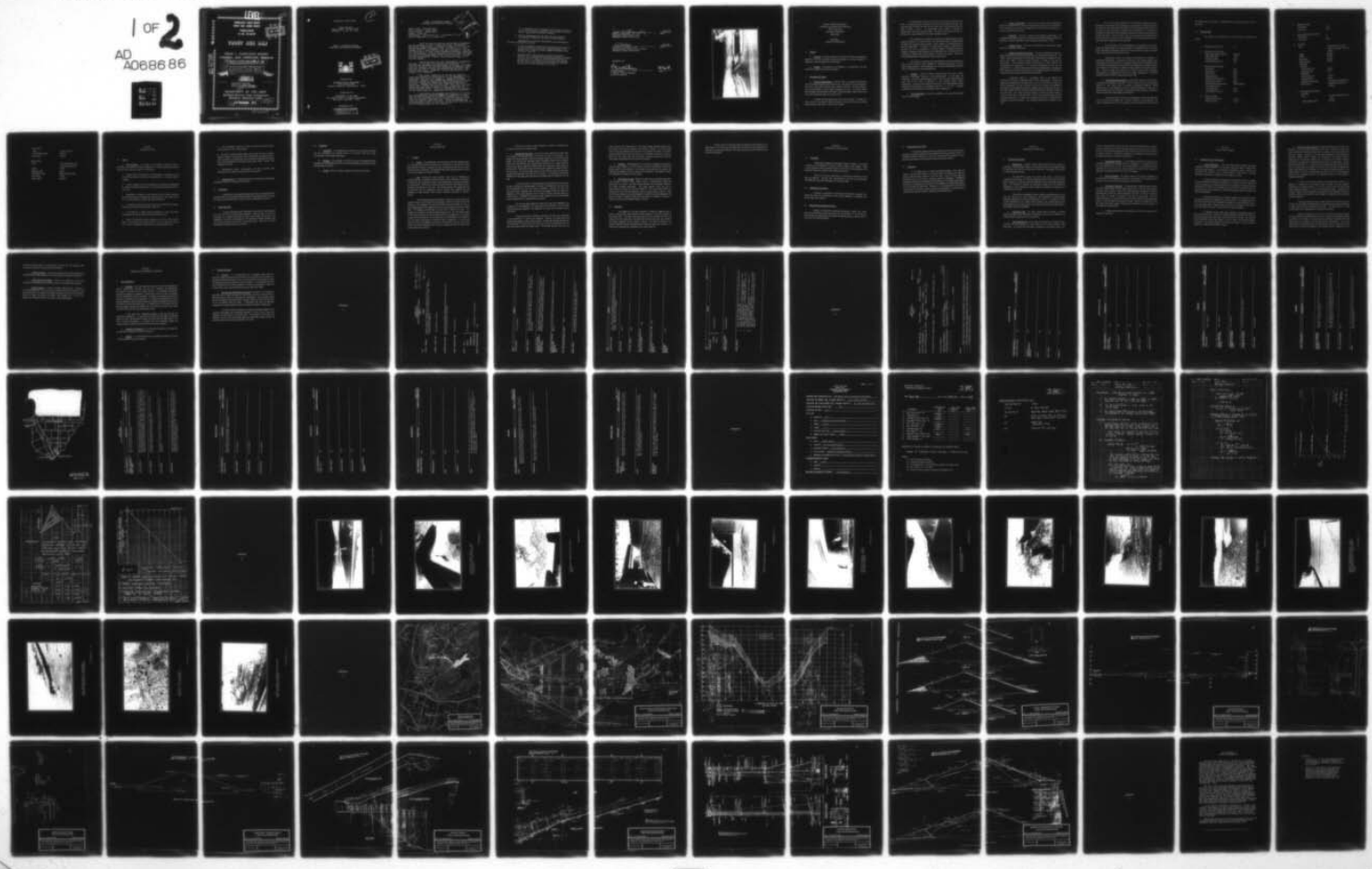

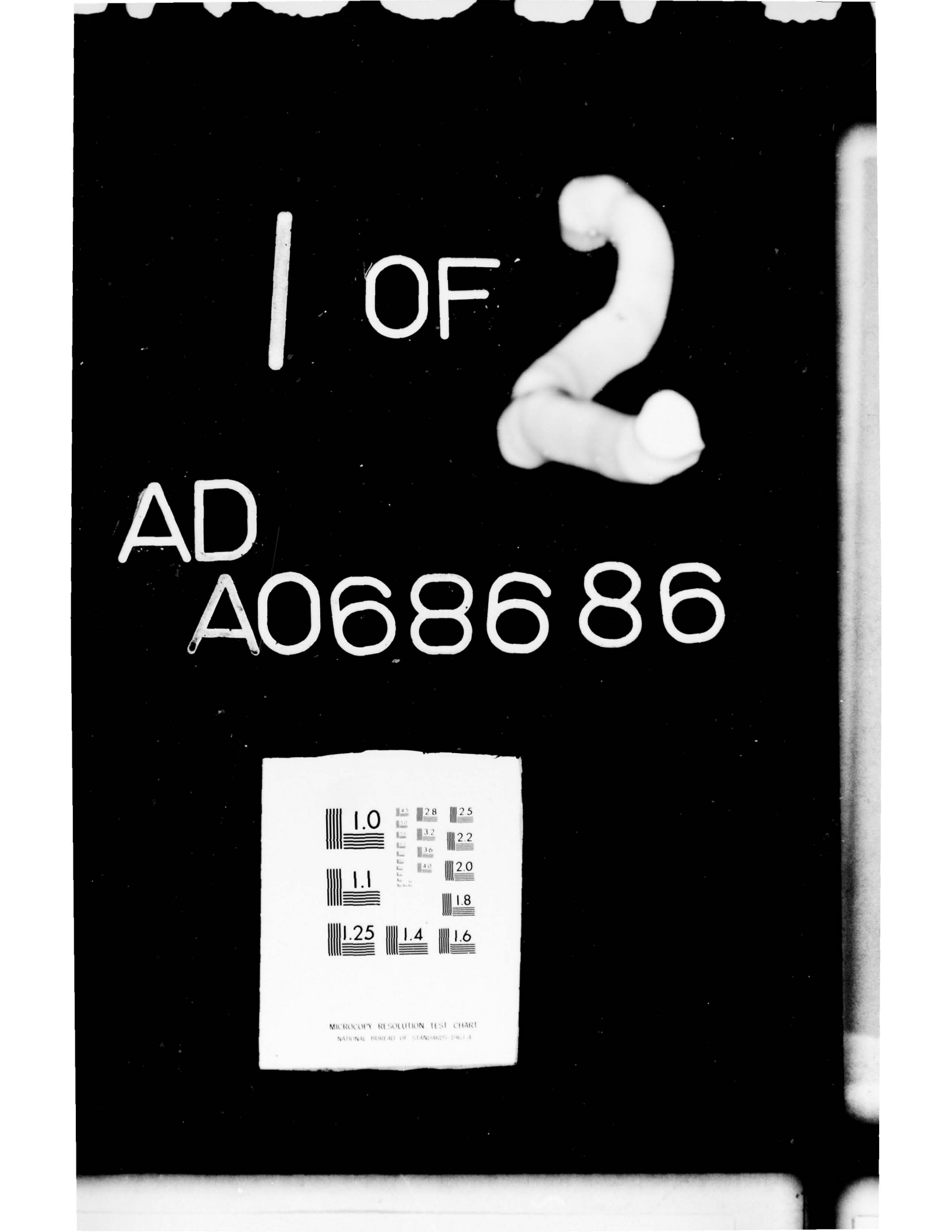
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LEVEL II

SCHUYLKILL RIVER BASIN
TROUT RUN, BERKS COUNTY
PENNSYLVANIA
ID NO. PA.00797

TROUT RUN DAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

(2) ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE.

(6) National Dam Inspection Program. Trout Run Dam National I. D. Number (PA00797), Schuylkill River Basin, Trout Run, Berks County, Pennsylvania. Phase I Inspection Report.

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DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

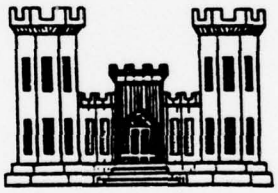
(11) SEPTEMBER 1978

(12) 97p.

SCHUYLKILL RIVER BASIN

TROUT RUN DAM
BERKS COUNTY, PENNSYLVANIA
NATIONAL I.D. NO. PA 00797

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared by:

WOODWARD-CLYDE CONSULTANTS
5120 Butler Pike
Plymouth Meeting, Pennsylvania 19462

Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

SEPTEMBER 1978

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Trout Run Dam
County Located: Berks County
State Located: Pennsylvania
Stream: Trout Run
Coordinates: Latitude 40° 20.1' Longitude 75° 42.5'
Date of Inspection: 30 August 1978

Trout Run Dam is owned by the Borough of Boyertown and was designed in 1963 by Glace and Glace, Incorporated, Harrisburg, Pennsylvania. Construction began in 1973 and the dam was completed in December, 1975. The facility is considered to be in good condition and well maintained. The dam is classified as a "High" hazard potential structure consistent with its potential to cause extensive property damage and possible loss of life downstream in the event of failure. The dam is also classified as a "Large" size structure based on its 104 foot height.

The design data and other supplemental information pertinent to this dam and reservoir were sufficient to evaluate the embankment and appurtenant structures. The hydrologic and hydraulic calculations presented in Appendix C indicate that the dam will pass the probable maximum flood (PMF) without overtopping. Therefore, the spillway system is considered to be "Adequate".

The visual inspection of the dam and reservoir facilities detected no deterioration of the embankment or the appurtenant facilities to suggest an impending hazardous condition. However, some undesirable seepage was noted to be occurring through and immediately above the downstream rock toe drain. Seepage was also noted immediately above the impact basin through the rock toe drain. Flow was also noted through the pond drain although it was reported that the sluice gate was closed. This flow through both the rock fill toe and impact basin is unexplained and should be evaluated.

Considering the adjudged good condition of the dam, the recommendations presented ~~below~~ are suggested to insure that the dam continues to function as designed and to insure that the residents downstream are warned when impending high flows are expected along the creek. These recommendations are presented in order of priority, but does not infer that the latter recommendations are not important.

1. It is recommended that the seepage noted through the rockfill toe as shown on Sheet 5a, Appendix B be inspected and evaluated by a registered professional engineer.

2. The flow discharging from the pond drain pipe should be investigated to determine the source of the discharge.

Recommendations concerning the operation and maintenance of the dam are presented as follows:

1. A formal procedure of observation and warning during periods of high precipitation should be developed because of the possibility of extensive property damage downstream during periods of high flow.

2. The Owner should also develop an inspection checklist together with a complete maintenance and operational procedure to insure that all items are inspected and maintained on a periodic basis. This checklist would insure that seepage, as noted on the downstream slope and through the pond drain system, would not be overlooked in the future.

John H. Frederick, Jr., P.E.
Maryland Registration 7301
Woodward-Clyde Consultants

9/22/78
Date

W S Gardner

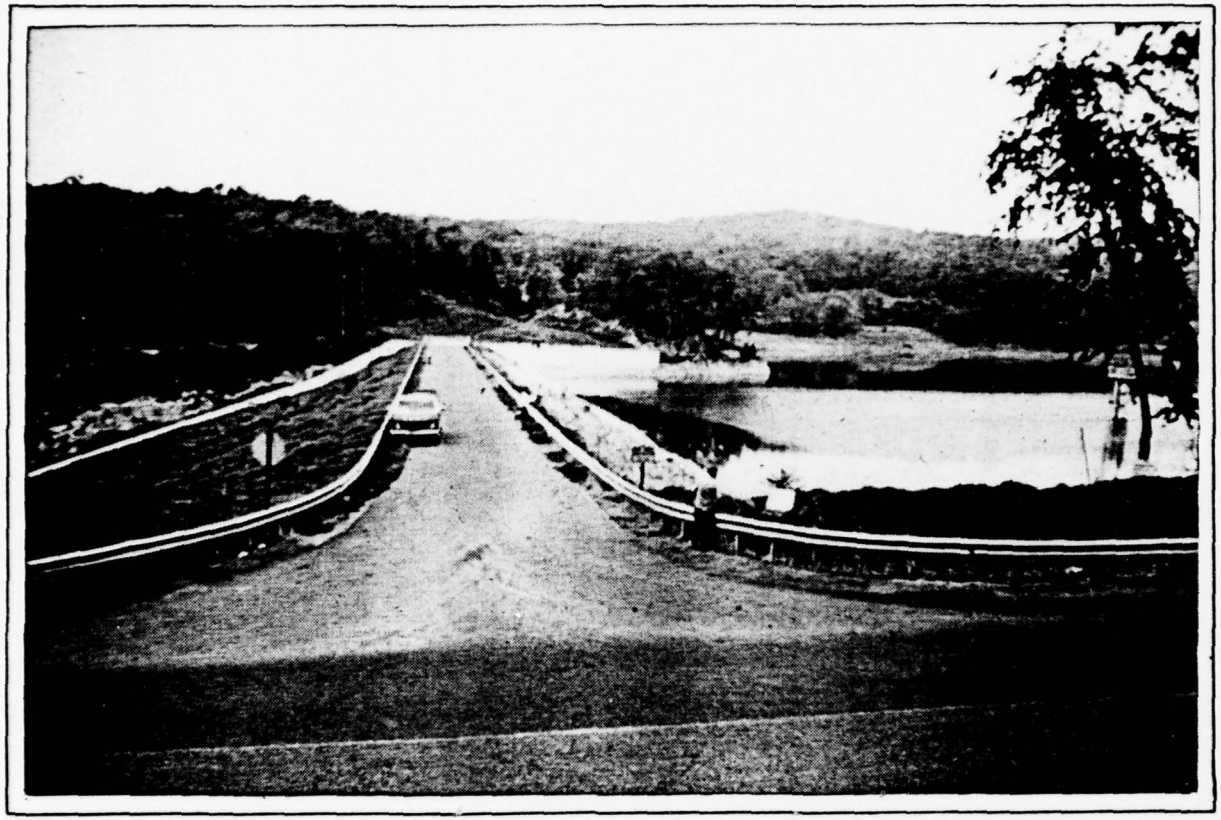
William S. Gardner, P.E.
Pennsylvanaia Registration 4302E
Woodward-Clyde Consultants

9/22/78
Date

APPROVED BY:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

28 Sep 78
Date



OVERVIEW
TROUT RUN DAM, BERKS COUNTY, PENNSYLVANIA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
TROUT RUN DAM
NATIONAL ID #PA 00797
DER #6-455

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Trout Run Dam is a rolled earth embankment with a downstream toe drain and a cutoff trench. The dam has a maximum height of 104 feet, a crest width of 25 feet, and a length of 460 feet. The dam contains a grout curtain beneath a cutoff trench excavated into rock. The cutoff trench, located beneath the centerline of the dam, is excavated approximately 20 feet into rock with a bottom base width of at least 12 feet.

A double line split-spaced grout curtain was installed. The holes are 5 feet on center. The maximum depth of the grout holes was 60 feet, and grouting pressures were on the order of 1 psi per foot of depth.

The downstream rock toe is underlain by a 3-layer sand, gravel and rock filter. The upstream slope is protected with rock from the crest to the toe. The upstream slope is 2.5H:1V from the crest to elevation 557. Below elevation 557, the slope increases to 4H:1V. The downstream slope contains 2 benches at approximately third points along the slope. The slope is 2.5H:1V from the crest to elevation 537. Below elevation 537 the slope increases to 3H:1V.

The intake tower is located at the upstream toe approximately midway along the centerline. The tower contains two water supply inlets at elevations 550 and 580, which discharge water through a 12-inch pipeline to the pumping station 280 feet downstream. In addition, the intake tower contains a pond drain at elevation 517.7 that is connected to a 30-inch diameter corrugated metal pipe encased in concrete, which discharges at the downstream toe. All three inlets are controlled by ARMCO gate valves located at the top of the tower. There is no access bridge between the embankment and the intake tower.

The spillway is located on the right abutment and was excavated into rock, as shown on Plates 7 and 9, Appendix E. The concrete ogee weir is 32 feet wide at elevation 602.5. Water discharges into a 32-foot wide 400-foot long chute and into a stilling basin at the downstream toe.

b. Location. Trout Run Dam is located across Trout Run, a minor tributary of Manatawny Creek, at a point approximately 1.3 miles above the confluence of Trout Run with Manatawny Creek. The dam is also located about 3.8 miles west of the center of Boyertown in Earl Township, Berks County, Pennsylvania. The dam site and reservoir are shown on USGS Quandrangle entitled, "Boyertown, Pennsylvania", at coordinates N 40° 20.1' W 75° 42.5'. A regional location plan of Trout Run Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as a "Large" dam consistent with its 104-foot height.

d. Hazard Classification. The dam has a "High" hazard classification because of the potential for extensive property damage and loss of life downstream at the confluence of Trout Run with Manatawny Creek and further downstream in Earlville along Manatawny Creek.

e. Ownership. The dam is owned by the Borough of Boyertown. All correspondence should be issued to Mr. Rowland Read, Borough Manager, Borough of Boyertown, 100 South Washington Street, Boyertown, Pennsylvania 19512.

f. Purpose of Dam. The dam was constructed to impound and supply water to the Borough of Boyertown.

g. Design and Construction History. The dam was designed by Glace and Glace, Incorporated of Harrisburg, Pennsylvania, for the Borough of Boyertown. The "Report Upon the Application of the Borough of Boyertown" was issued on 2 April 1964 by Mr. Joseph J. Ellam, Hydraulic Engineer, on behalf of the State of Pennsylvania. The construction permit was issued on 14 April 1964 by the Commonwealth of Pennsylvania. The foundation investigation for this dam was performed by F. T. Kitlinski Associates of Harrisburg, Pennsylvania, in the spring of 1963. Between 1964 and 1973, construction was delayed because of difficulties relocating a State Legislative Route around the reservoir.

Construction began on 1 November 1973, by the Number One Construction Company of Delaware, West Pittston, Pennsylvania. Construction inspection and management was performed by Mr. Lynn H. Griffith for Glace and Glace, Incorporated. In early 1974, work was limited to clearing and grubbing of the reservoir and embankment foundation, together with the installation of the 12-inch water supply line from the dam to Boyertown Reservoir located northeast of Trout Run Dam. Core trench excavation started in the fall and winter months of 1974 and 1975, and by 14 February 1975, Trout Run was diverted through a 30-inch corrugated metal pipe. In March 1975, foundation excavation was completed and foundation grouting commenced. The foundation grouting was completed 6 May 1975.

Mr. Lynn Griffith reported that the foundation grouting work was performed by Continental Drilling Company as a subcontractor to Glace and Glace. The maximum grout hole depth was 60 feet, and terminal grout pressures were on the order of 1 psi per foot, but no pressure was to exceed 60 psi. Grouting was considered complete when 60 psi pressure was achieved or when the hole refused to accept more grout. There was some minor grout communication between holes when the mixes were thin (4:1; water to cement). There was no noticable travel of grout upstream or downstream of the centerline.

By 26 November 1975, the embankment was completed and the entire project was approximately 91 percent completed by 16 December 1975. The intake tower was reported complete by 4 March 1976, the pond drain was closed on 2 March 1976, and the reservoir was full 22 May 1978.

Construction control soil testing was performed by Astrotech of Harrisburg, Pennsylvania. Bi-monthly summaries of the in-place density tests indicate that all density tests were in excess of 100 percent of the Standard Proctor Test. Specifications required that the material be compacted to a minimum density of 98 percent of the optimum dry density, as determined by the Standard Proctor Test. Concrete testing was performed by General Testing Labs, Allentown, Pennsylvania, as a subcontractor to Glace and Glace, Incorporated. The official completion date of the dam is recorded as 30 June 1976.

h. Normal Operating Procedures. Under normal conditions a dam tender is not required for operation of this dam. Trout Run Dam serves as an impounding reservoir to store water, which is pumped to Boyertown Reservoir located approximately 2 miles northeast of the site. Boyertown Reservoir is kept full by pumping water from Trout Run Dam via the pumping station through a 12-inch pipe. Water is treated after leaving Boyertown Reservoir.

The minimum flow of 0.18 cfs is maintained by a pipe which taps water from the 12-inch water supply line. This tap is located in the pumphouse. The water is discharged into Trout Run through a pipe which outlets at the left wall of

the impact basin. Excess water is discharged over the spillway located at the right abutment.

1.3 Pertinent Data.

The summary of pertinent data for Trout Run Dam is summarized as follows.

a.	Drainage Area (sq. miles)	1.15
b.	Discharge at Dam Site (cfs)	
	Max. Known Flood at Dam Site	Unknown
	Design High Water	1,590
	Discharge at PMF	1,810
	Minimum Required Flow	0.18
c.	Elevation (feet above MSL)	
	Top of Dam	612.0
	Spillway Crest	602.5
	Normal Pool	602.5
	Design High Pool	608.1
	Pond Drain Entrance Invert	517.5
	Pond Drain Exit Invert	500.0
	Water Supply Entrance Inverts	550.0 and 580.0
	Water Supply Invert to Pump Station	545.5
	Stilling Basin Exit Invert	497.5
d.	Reservoir (miles)	
	Length at Normal Pool	0.5 est.
	Maximum Fetch	0.5 est.

e.	Storage (acre-feet)	
	Normal Pool	1,169
	Top of Dam	1,652
f.	Reservoir Surface Area (acres)	
	Normal Pool	42
	Top of Dam	640.0
g.	Dam Data	
	Type	Compacted fill with cutoff trench and double line grout curtain.
	Length	460 feet
	Height	104 feet
	Crest Width	25 feet
	Roadway Width	20 feet
	Side Slopes	
	Upstream	
	Crest to Elev. 557	2.5H:1V
	Below Elev. 557	4H:1V
	Downstream	
	Crest to Elev. 537	2.5H:1V
	Below Elev. 537	3H:1V
	Benches (10 feet wide)	Two benches, elevations vary.
	Grout Curtain	Double line curtain, split spacing.
h.	Intake Data (Intake Tower)	
	Pond Drain	
	Type	30 inch CMP encased in concrete.
	Length (approximate)	605 feet

Water Supply	
Type	12-inch iron pipe.
Length (approximate)	650 feet
Sluice Gates	ARMCO

i. Spillway Data

Type	Concrete ogee weir with chute to stilling basin.
Length	32 feet
Upstream Slope	Level
Downstream Slope	29.8% to impact basin.
Chute Width	32 feet
Chute Length	400 feet

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of the available engineering data is presented in the checklist attached as Appendix A. Principal documents containing pertinent data used for this report are listed below.

1. "Report Upon the Application of the Borough of Boyertown" by the State of Pennsylvania, dated 2 April 1964, prepared by J. J. Ellam, Hydraulic Engineer.

2. "Permit" prepared by the Commonwealth of Pennsylvania, Department of Forests and Waters (Department of Environmental Resources), dated 14 April 1964.

3. "Application to Construct a Dam Across Trout Run Creek", submitted to the Commonwealth of Pennsylvania, dated 28 January 1964, submitted by Mr. K. Linwood Stauffer, President, Borough of Boyertown.

4. 12 drawings submitted by Glace and Glace, Incorporated, Harrisburg, Pennsylvania, stamped "as-constructed", dated 1973.

5. A 26-page set of design drawings prepared by Glace and Glace, Incorporated, Harrisburg, Pennsylvania, dated December 1963.

6. "Draft, Environmental Impact Statement for the Trout Run Earthfill Dam", for the Borough of Boyertown, Berks County, Pennsylvania; Docket No. D-72-227 CP, prepared by Delaware River Commission, May 1973.

7. Color photographs covering all phases of construction, dated January 1974 through June 1976: 85 photographs.

8. Bi-monthly resident engineer reports submitted by Mr. Lynn H. Griffith, Resident Engineer for Glace and Glace, Incorporated, Harrisburg, Pennsylvania, submitted to the Department of Environmental Resources, Division of Dams and Encroachments, Harrisburg, Pennsylvania, dated 2 January 1974 through 3 June 1976.

9. Miscellaneous memos, correspondence and other pertinent data associated with the design and construction of this project.

b. Design Features. A complete description of the features of this project is discussed in Section 1.2, "Description of Project".

2.2 Construction.

A description of the available construction history, as determined from the Department of Environmental Resources (DER) files, discussions with the Owner and with the Resident Engineer for Glace and Glace, is described in Section 1.2.

2.3 Operational Data.

The only operational record maintained is the quantity of water pumped from Trout Run Dam to the Boyertown Reservoir. Minimum flow of 0.18 cfs is maintained by a bleed-off pipe from the 12-inch water supply line located in the pumphouse. This water is discharged into the downstream channel through a pipe which outlets through the left wall of the impact basin. There are no written operational/maintenance records for this dam.

2.4 Evaluation.

a. Availability. All engineering data produced in this report and studied for this investigation was provided either by the DER; Glace and Glace, Incorporated; or the Borough of Boyertown.

b. Adequacy. Data included in the DER files and the supplemental data received from the Designer and Owner, are considered adequate to evaluate the dam and appurtenant structures.

c. Validity. There is no reason to question the validity of the data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B, and are summarized and evaluated as follows. In general, the dam and appurtenant facilities are in good condition and well maintained. The Borough of Boyertown employees are on the site every day and inspect the reservoir and dam.

b. Dam. During the visual inspection there were no indications or evidence observed of embankment surface cracks, unusual movement or cracking at or beyond the toe, sloughing or erosion of the embankment or the abutment slopes, or riprap failures. There were no unusual movements observed indicating vertical or horizontal misalignment of the crest. The junction between the embankment and the abutment, and the embankment and the spillway were inspected and are considered in good condition with no signs of distress, movement or excessive erosion.

The drainage pipes located through the walls of the impact basin were inspected. Water was not flowing from these pipes. However, as shown on Sheet 5a, Appendix B, some seepage was noted immediately above and through the rock toe drain approximately 40 feet upslope from the toe and immediately above the impact basin. The seepage was estimated to be less than 2 gallons per minute. This seepage was emanating from approximately elevation 537. This corresponds closely to the junction between the rock toe and the select fill embankment. This location is approximate and based on a visual inspection of the embankment and comparison with the typical cross-sections, as shown on Plate 4, Appendix E. It is not known what the cause of this seepage is, but there is the possibility that the 3-layer filter blanket is partially clogged and that the water is passing over the top of the blanket and emanating at the surface.

There were no signs of riprap distortion, movement or deterioration. The quality of the rock is considered good.

c. Appurtenant Structures. At the time of the inspection, the water level of the reservoir was approximately 8 feet below the crest of the spillway. This exposed the spillway approach channel and allowed inspection of the entire spillway system. The concrete weir, approach channel, discharge channel, and the highway bridge across the spillway were inspected and observed to be in good condition. There were no signs of significant distress other than temperature cracks along the spillway walls. There were no signs of retaining wall movement or discontinuities in the chute slab. All the weep holes along the chute and the retaining walls were inspected and observed to be clean but not flowing. It is reported by the Borough Manager that these weep holes discharge some seepage when the reservoir is at full pool.

As the outlet tower is located approximately 260 feet from the crest of the dam, and there is no access bridge to the tower, an inspection of the tower could not be performed nor could the valves be exercised. However, the tower was observed through a telephoto lens, and the portions exposed above the water level appeared to be in good condition, with no signs of distress, concrete spalling or unusual cracks. The ARMCO valves were visually inspected from the same vantage point and appeared to be in good condition and clean.

The 12-inch water supply line is below the water level embedded in the embankment to the pumphouse. This pipe could not be inspected. Only the valves and the pumps were inspected. They appeared to be clean, well lubricated and well maintained.

The pond drain pipe is located at the base of the tower and is embedded in the embankment. It could not be inspected. However, the impact basin was inspected and observed to be in good condition. The Borough Manager reported that the sluice gate of the pond drain was closed, but water was discharging from the pond drain pipe through the impact basin. The Borough Manager and Glace and

Glace's engineer were made aware of the possible leakage through the pond drain sluice gate, or the unlikely possibility that the pipe is leaking. The water coming from this pipe was observed to be clear with no suspended finds noted. This system should be checked to be sure that the pipe is not cracked or leaking at the joints. Water from the impact basin and the spillway converge approximately 100 feet downstream and discharge into the natural rock channel.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of siltation, slope instability, or other features that would significantly affect flood storage capacity of the reservoir. The drainage basin surrounding the reservoir was inspected and assessed to be quite stable and well vegetated. Side slopes are stable, well vegetated, and range from flat to steep.

e. Downstream Channel. Below the impact basin and spillway, the stream flows through a narrow, steep, wooded valley for approximately 2,000 feet downstream of the dam. The valley becomes broader and the gradient flattens as the stream proceeds downstream. The valley gradient below the dam is approximately 6.7 percent for the first 2,000 feet. The valley gradient above the confluence of Trout Run and Manatawny Creek is approximately 3 percent. There are 10 homes between the dam and Manatawny Creek that would be damaged in the event of a failure. Several of these homes are subject to flooding in the event of large flows and have experienced flooding in the past.

3.2 Evaluation.

The inspection of the dam disclosed no evidence of apparent past or present movement that would indicate existing instability of the dam, spillway or the intake tower. The pond drain sluice gate was not exercised, but flow was observed into the impact basin, indicative that the pond drain gate was leaking or the unlikely possibility that the conduit is leaking. This should be checked. The spillway, approach channel, discharge channel and stilling basin were inspected. All features of this spillway are considered to be in good condition.

Portions of the intake tower above the water level were found to be in good condition. As viewed from a telephoto lens, the ARMCO valves appeared to be clean and in visually good condition. The water supply pipes and the pond drain pipe could not be inspected.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures.

Operational procedures are discussed in detail in Section 1.2. As stated in Section 1.2, the operation of the dam does not require a dam tender. Under normal conditions, water is pumped through a 12-inch line at the pumphouse to the Boyertown Reservoir, located 2 miles northeast of the site.

There are no written operational or maintenance procedures for this dam and reservoir. Minimum flow requirements of 0.18 cfs are automatically maintained by a pipe which discharges into the impact basin.

4.2 Maintenance of the Dam.

The dam is maintained by the Borough of Boyertown employees who periodically check the embankment, remove woody vegetation as necessary, and perform other minor repairs.

4.3 Maintenance of Operating Facilities.

Borough of Boyertown employees periodically inspect the intake structure and the spillway for accumulations of trash and debris. It is reported that the pond drain and water supply sluice gates are operated several times per year to insure that they function properly.

4.4 Warning Systems in Effect.

The Boyertown Borough Manager reported there are no formal warning procedures or systems established to be followed during periods of heavy rainfall. If hazardous conditions develop, or if high flow conditions are anticipated, the local police and Department of Environmental Resources would be notified.

4.5 Evaluation.

It is judged that the current operating procedure, which does not require a full-time dam tender, is a realistic means of operating the relatively simple control facilities located at Trout Run Dam. Since no written operating procedures exist at this time, a procedure should be developed. Maintenance procedures should also be developed and incorporated into the operating procedures, particularly as the operator was unaware of the seepage on the downstream slope or the flow through the pond drain. Therefore, it is concluded that the operator be provided with an inspection checklist that would be completed on a periodic basis to insure that all items are carefully inspected and documented as so.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. Available original design information was limited to statements in the Application Report, a letter from the State to the Designer, dated 26 December 1962, and a few calculations in DER files. The designer was not able to furnish design information.

The watershed is small, 1.15 square miles, about 1 mile long and averaging 0.9 miles wide. The hillside slopes draining into the reservoir are steep, about 15 percent. Elevations range from 1080 feet to the normal pool elevation of 602.5. The watershed is greater than 80 percent wooded with little residential development. As the watershed is steep, residential development is expected to be limited in the near future.

The spillway was designed to have a maximum discharge capacity of not less than 1,970 cfs, the value required by the Department of Environmental Resources (Department of Forests and Waters), "C" curve. In accordance with the criteria established by the Federal (OCE) Guidelines, the recommended spillway design flood for this "Large" size dam and "High" hazard potential classification is the probable maximum flood (PMF).

b. Experience Data. No water surface elevation records or rainfall records are kept. There have been no significant storms since the reservoir was filled, reaching the spillway crest on 22 May 1978.

c. Visual Observations. On the date of the inspection, no conditions were observed that would indicate the outlet capacity to be reduced during a flood occurrence. It is noted that the forebay is spanned by the highway bridge. The

minimum vertical distance between the weir crest and the underside of the bridge is 6.5 feet compared to the 9.5 foot difference between the weir crest and the top of the dam. Thus, at heads approaching 6.5 feet, the bridge will start to have an effect on spillway discharge. Observations regarding the downstream channel, spillway condition and reservoir are located in Appendix B.

d. Overtopping Potential. The overtopping potential of this dam was evaluated by approximate methods, as shown in Appendix C. The peak PMF inflow rate was estimated to be 2,130 cfs. The spillway capacity with a head of 6 feet was calculated to be 1,810 cfs, which, when combined with available flood storage, is adequate to discharge the PMF storm without overtopping.

e. Spillway Adequacy. The spillway system for this dam is "Adequate" as the PMF storm will not overtop the structure. The tailwater is estimated to be 106 feet below the top of the dam during passing of the PMF storm.

f. Downstream Conditions. For approximately 2,000 feet below the dam, the stream flows through a narrow, steep, wooded valley. Then the valley gradient flattens to about 3 percent. There are 10 homes above the confluence of Trout Run and Manatawny Creek that would be damaged in the event of a failure. Several of these homes are subject to flooding in the event of large flows. The first downstream dam is 1.3 miles below the Trout Run Dam (200 feet above Manatawny Creek). As the drainage area through the bridge is twice the drainage area of the dam, and as the bridge is subject to flooding from Manatawny Creek, the capacity of the bridge was not determined.

A "High" hazard potential classification for this dam is consistent with downstream conditions.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The visual observations indicated no existing embankment stability problems. The upstream riprap was stable, of good quality, and quite good condition. The downstream embankment slope is covered with Crownvetch and observed to be in good condition. There were no noticable undulations, distortions or misalignment of the slope or the crest.

As shown on Sheet 5a in Appendix B and discussed in Section 3, seepage was noted through the downstream embankment at a rate of less than 2 gallons per minute. Evidence on the slope indicates that this seepage is relatively constant. Considering the location of this seepage and the fact that the weep holes on the impact basin were not discharging, an undesirable seepage condition is evident and should be investigated.

The principal spillway was thoroughly inspected from the intake channel to the stilling basin, and is judged to be in good condition. The exposed portions of the intake tower were visually inspected and judged to be in good condition as were the 3 sluice gate valves. However, these valves were not exercised in that there is no access bridge to the tower nor was there a boat readily available.

An inspection of the impact basin revealed flow emerging through the 30-inch pond drain pipe. However, the Borough Manager indicated that the sluice gate was closed and that water should not be flowing from the pipe. This condition can be attributed to one of two things: (1) The sluice gate is not sufficiently sealed, and (2) there is an unlikely possibility that the pipe is leaking. This flow should be assessed by a registered professional engineer.

b. Design and Construction Data. Design documentation contained in the Department of Environmental Resources (DER) files or provided by Glace and Glace, Incorporated, Harrisburg, Pennsylvania, included a structural analysis of the pond drain culvert, a summary of the engineering properties of the embankment materials, seepage analysis through the embankment, and several hydraulic calculations for the spillway, together with a summary of the stability analysis performed on the upstream and downstream sections of the embankment. The soil tests were performed by F. T. Kittlinski and Associates, and their results indicate that the friction angle and cohesion of the soil is 30° and 360 psf, respectively. These values appear to be reasonable for the types of materials located in this geologic region. Similarly, the permeability assumption of 2×10^{-7} centimeters per second is also a reasonable value for the specified materials and the degree of compaction specified.

A review of the stability analysis summarized herein as Plate 11 in Appendix E indicates that the minimum factor of safety for rapid drawdown conditions on the upstream slope is 1.41 and the minimum factor of safety under steady seepage conditions is 1.54 for the downstream slope. Considering the methods of analysis used, the geometric assumptions and soil properties used in the computer analysis, these factors of safety appear to reasonable and are assumed correct and adequate.

Structural calculations for the intake tower and the spillway were not available, but the design drawings showing the reinforcing steel and the proportions of these structures were available and reviewed. The configurations of these systems appear to be reasonable and are judged to be adequate.

Based on discussions with Mr. Lynn H. Griffith, the resident engineer for Glace and Glace, Incorporated, and a review of the bi-monthly progress reports submitted by Mr. Griffith, it is judged that the embankment materials were most likely placed in accordance with the specification requirements. Test results submitted on the bi-monthly reports indicate that the minimum inplace density test results were in excess of 100 percent of the Standard Proctor Compaction criteria

(minimum required density is 98 percent), indicating that the materials were compacted in excess of the specification requirements.

c. Operating Records. The only records associated with the operation are the quantities of water pumped from Trout Run Reservoir to Boyertown Reservoir.

d. Post-Construction Changes. There are no reports nor is there any evidence that modifications were made to this dam or the appurtenant structures.

e. Seismic Stability. This dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone is stable under static conditions, it can be assumed safe for any expected earthquake conditions. Since the static factors of safety for sudden draw-down and steady state seepage are 1.41 and 1.54, respectively, the seismic stability of the dam is considered adequate.

SECTION 7
ASSESSMENT AND REMEDIAL MEASURES

7.1 Dam Assessments.

a. Evaluation. The visual inspection and review of the limited design and as-built documentation indicates that the dam, foundation and appurtenant structures of Trout Run Dam are in good condition. The hydrologic and hydraulic computations presented in Appendix C indicate that the dam will pass the probable maximum flood (PMF) without overtopping. Therefore, the spillway systems of this structure are considered to be "Adequate". It is noted that, although the structure has been designed to pass the PMF, downstream flooding is expected along the creek and further into Earlville, Pennsylvania. It is expected that, in the event of failure, extreme property damage and possible loss of life would most likely occur along Trout Run Creek and further along Manatawny Creek.

It was noted that undesirable seepage is occurring through the downstream embankment. It is also noted that the pond drain gate was reported closed, but flow was discharging through the conduit into the impact basin. This flow is currently unexplained. In summary, both the undesirable seepage and unexplained flow through the pond drain facilities should be evaluated.

b. Adequacy of Information. The information available for this inspection was sufficiently adequate to evaluate the structure.

c. Urgency. It is recommended that the suggestions presented in Section 7.2 be implemented as soon as practical.

7.2 Remedial Measures.

a. Facilities. It is recommended that the seepage noted along the downstream slope at approximately elevation 537 be inspected and evaluated by a registered professional engineer. Since it is reported that the sluice gate was closed but leakage was occurring through the pond drain pipe, it is recommended that this pipe be inspected for the unlikely possibility of cracks or the possibility of debris at the pond drain, which could be preventing the sluice gate from closing.

b. Operation and Maintenance Procedures. Because of the downstream populated area, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning downstream residents along Trout Run that high flows are to be expected along the creek. If abnormally high flows are expected, procedures for evacuating persons within the flood plain should be implemented.

The Owner should also develop an inspection checklist together with a complete maintenance and operational procedure to insure that all items are inspected and maintained on a periodic basis. This checklist would insure that seepage, as noted on the downstream slope, and undesirable leakage through the pond drain system would not be overlooked in the future.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Trout Run Dam*

ID # *PA 00797*

ITEM	REMARKS
AS-BUILT DRAWINGS	*Several "As-Built" drawings were submitted by Glace and Glace to the inspection team for use in preparing the report. DER files contained design drawings.*
REGIONAL VICINITY MAP	*See Appendix E of report.*
CONSTRUCTION HISTORY	*Glace and Glace Resident Engineer prepared bi-monthly reports describing construction activities.*
TYPICAL SECTIONS OF DAM	*See Appendix E.*
OUTLETS - PLAN	*See Appendix E.*
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	*See Appendix C of this report.*
RAINFALL/RESERVOIR RECORDS	*None*

ITEM	REMARKS
DESIGN REPORTS	*None available.*
GEOLOGY REPORTS	*Yes. A geologic report was prepared by Professor James L. Dyson, 24 June 1963 describing the geology at the site. See Appendix F of this report.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*Design computations available in DER files contained calculations pertaining to: drainage culverts, embankment soil properties, spillway calculations, some hydrologic and hydraulic calcultions.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*Some data was available and is discussed in the text of this report.*
POST-CONSTRUCTION SURVEYS OF DAM	*None*
BORROW SOURCES	*The Resident Engineer for Glace and Glace indicated that all borrow materials came from the specified sources.*

ITEM	REMARKS
MONITORING SYSTEMS	*Yes. There are five accustical monitoring stations containing 13 probes. These were monitored approximately two-times per year but, lately, there have been no readings.*
MODIFICATIONS	*None*
HIGH POOL RECORDS	*None*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None*
MAINTENANCE OPERATION RECORDS	*None*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*See Appendix E.*
OPERATING EQUIPMENT PLANS & DETAILS	*See Appendix E.*
MISCELLANEOUS	1. *"Report in the Geology of the Site of the Trout Run Impounding Dam" by J.L. Dyson, 24 June 1963.* 2. *"Report Upon the Application of the Borough of Boyertown", dated 2 April 1964, prepared by J.J. Ellam, Hydraulic Engineer.* 3. *"Permit" issued by the State of Pennsylvania, dated 14 April 1964 to construct Trout Run Dam.* 4. *"Application" to construct Trout Run Dam, dated 23 December 1963.* 5. *85 color photographs of construction.* 6. *"Draft, Environmental Impact Statement for the Trout Run Earthfill Dam", Docket No. D-72-227 CP prepared by the Delaware River Basin Commission.*

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Trout Run Dam* County *Berks* State *Pennsylvania* National ID # *PA 00797*

Type of Dam *Rolled Earth* Hazard Category *I (High)*

Date(s) Inspection *30 Aug. 1978* Weather *Cloudy, Warm, Humid* Temperature *70's - 80's*

Pool Elevation at Time of Inspection *594.5* M.S.L. Tailwater at Time of Inspection *500.3* M.S.L.

Inspection Personnel:

Mary Beck (Hydrologist)
Ray Lambert (Geologist) (8/29/78)
John H. Frederick, Jr. (Geotechnical)
Vince McKeever (Hydrologist)
John Boschuk, Jr. (Geotechnical/Civil)

John Boschuk, Jr. Recorder

Remarks:

Messrs. Max Stoner, Glace & Glace; Larry Comunale, Borough of Boyertown; Lynn Griffith, Glace & Glace; Rowland Read, Borough Manager; and Al Cunnius, Operator were on site and assisted during the inspection.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	*N/A*	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	*N/A*	
DRAINS	*N/A*	
WATER PASSAGES	*N/A*	
FOUNDATION	*N/A*	

CONCRETE/MASONRY DAMS

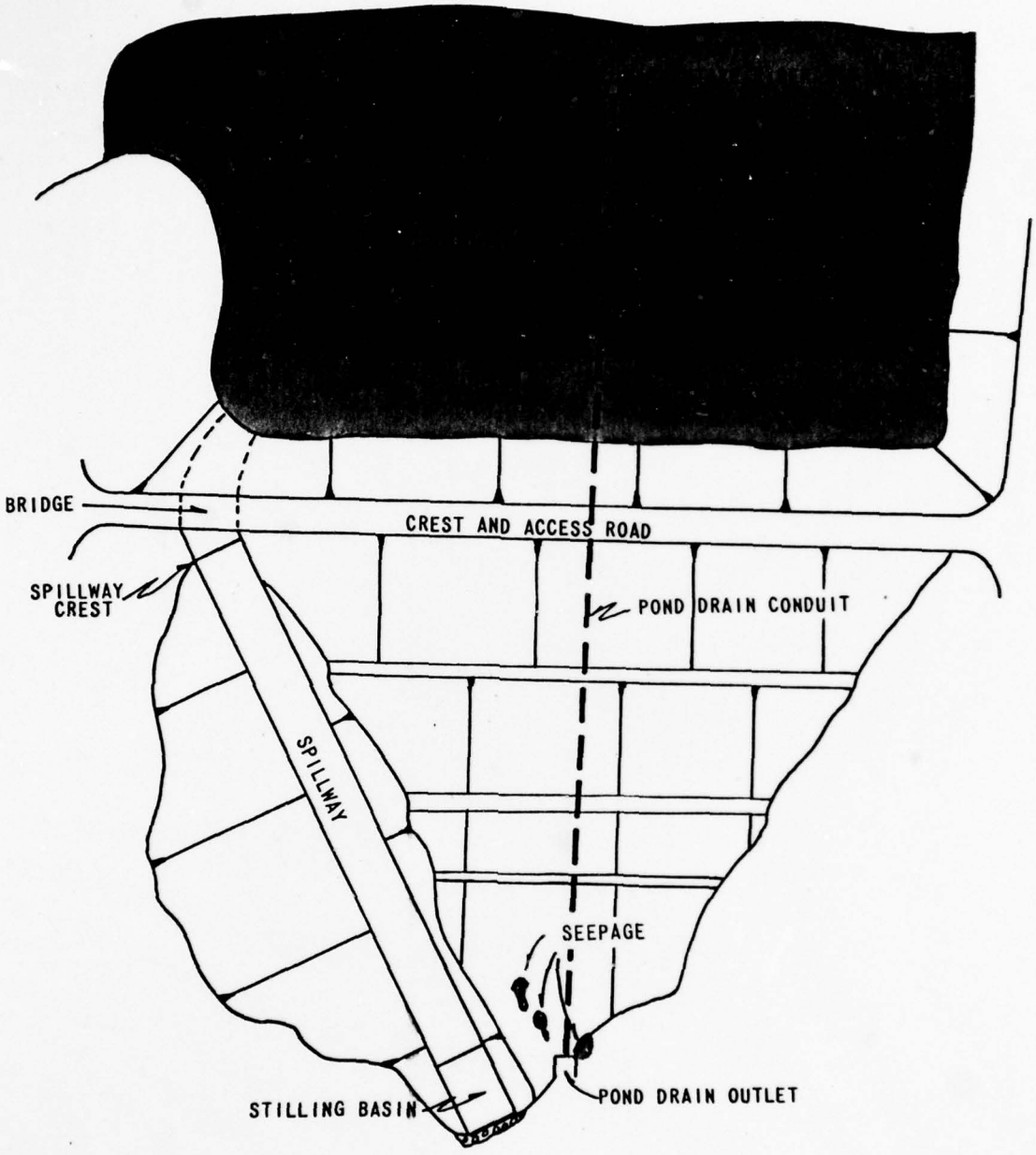
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*N/A*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*N/A*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*None observed.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*No unusual movements were observed.*	
RIPRAP FAILURES	*None observed.*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*The junctions were in good condition with no signs of distress, movement or excessive erosion.*	
ANY NOTICEABLE SEEPAGE	*Yes. See sheet 5a. Some slight seepage was noted through the rock toe drain about 40 feet (slope distance) upslope from the toe. The rate was estimated to be less than two gpm.*	
STAFF GAGE AND RECORDER	*None*	
DRAINS	*Yes. The toe drain discharge pipes feeding into the pond drain impact basin were dry.*	



SEEPAGE LOCATION PLAN
TROUT RUN RESERVOIR DAM

SHEET 5a OF 11

OUTLET WORKS
(POND DRAIN AND WATER SUPPLY)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*The outlet conduit could not be inspected because the 30 inch concrete pipe is buried in the embankment.*	
INTAKE STRUCTURE	*None noted as observed with a telephoto lense. The tower stands 9.5 feet above the water and is 300± feet from the waters edge. The exposed portion of the tower was visually inspected. The Armco sluice gates were not exercised because a boat was not readily available to gain access to the tower.*	
OUTLET STRUCTURE	*The impact basin was found to be in good condition with no spalling, cracking or distortions of the structure noted.*	
OUTLET CHANNEL	*The channel is founded on bedrock and is considered to be in good condition.*	
EMERGENCY GATE	*The 30 inch sluice gate pond drain was not exercised. The Owner's representative indicated that it was closed but an inspection of the outlet pipe showed flow on the order of 30 to 50 gpm. The Owner indicated that the gate may not be seated completely.*	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*Good condition. Minor damage to the weir has been caused by large stones being dropped from the roadway above.*	
APPROACH CHANNEL	*Good condition.*	
DISCHARGE CHANNEL	*Good condition.*	
BRIDGE AND PIERS	*Good condition.*	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*N/A*	
APPROACH CHANNEL	*N/A*	
DISCHARGE CHANNEL	*N/A*	
BRIDGE AND PIERS	*N/A*	
GATES AND OPERATION EQUIPMENT	*N/A*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER	*Accustical monitoring probes were installed under the direction of Dr. Robert Koener of Drexel University. The are reportedly monitored once or twice a year. There are five stations and 13 probes. Results of the readings are unknown.*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*Side slopes are stable, well vegetated and range from flat to steep. Since the reservoir was 8 feet below normal pool these sections of the slopes were also observed and noted to be in good condition.*	
SEDIMENTATION	*There was no significant sedimentation noted. The reservoir water was noted to be fairly clear indicative of a slight quantity of suspended solids.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*The stream flows through a narrow, steep, wooded valley for about 2000 feet downstream of the dam. The valley becomes broader and the gradient flattens.*	
SLOPES	*The valley gradient below the dam is 6.7 percent for 2000 feet below the dam. The valley gradient above the confluence of Trout Run and Manatawny Creek is about three percent.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*There are 10 homes between the dam and Manatawny Creek that would be damaged in the event of a failure. Several of these homes are subject to flooding in the event of large flows.*	

APPENDIX

C

TROUT RUN DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *80% wooded, little residential development.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *602.5 (1169 Acre-Feet)*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *612 (1652 Acre-Feet est.)*

ELEVATION MAXIMUM DESIGN POOL: *607.5*

ELEVATION TOP DAM: *612.0*

SPILLWAY

a. Elevation *602.5*

b. Type *Concrete ogee weir and chute.*

c. Width *32 feet.*

d. Length ----

e. Location Spillover *Right abutment.*

f. Number and Type of Gates *None*

OUTLET WORKS:

a. Type *Intake tower.*

b. Location *Toe of upstream slope.*

c. Entrance inverts *579.5 and 549.5*

d. Exit inverts *Directly to pumping station.*

e. Emergency draindown facilities *30 inch CMP at bottom of intake tower.*

HYDROMETEOROLOGICAL GAGES:

a. Type *None*

b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: *Not determined.*

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

Date: 9/6/78
By: MFB
Sheet: 2 of 8

DAM Trout Run Nat. ID No. PA00797 DER No. 6-455

	ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1.	Min. Crest Elev., ft.	612.0		
2.	Freeboard, ft.	4.0		
3.	Spillway(1) Crest Elev, ft.	602.5		
3a.	Secondary(2) Crest Elev, ft.	—		
4.	Max. Pool Elev., ft.	608.1		
5.	Max. Outflow(3), cfs	1970		
6.	Drainage Area, mi^2	1.15		1.12
7.	Max. Inflow(4), cfs			
8.	Reservoir Surf. Area, Acre	42		42
9.	Flood Storage(5), Acre-Feet			
10.	Inflow Volume, ft^3			

Reference all figures by number or calculation on attached sheets:

Example: 3A - Drawing No. xxx by J. Doe, Engr., in State File No. yyyy.

NOTES:

(1) Main emergency spillway.

(2) Secondary ungated spillway.

(3) At maximum pool, with freeboard, ungated spillways only.

(4) For columns B, C, use PMF.

(5) Between lowest ungated spillway and maximum pool.

Date: 9/6/78
By: MEB
Sheet: 3 of 8

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Item (from Sheet 2)	Source
1A, 3A	As-Built Drawings
2A, 4A, 5A, 6A	Application Report dated April 2, 1964
8A	Notice of Public Hearing, Delaware River Basin Commission, May 1973.
6C	USGS Map Boyertown (1973)
8C	Measured from drawings

Classification - (Ref. Recommended Guidelines for Safety Inspection of Dams)

1. The hazard potential is rated as "High" as there would be loss of life if the dam failed.

2. The size classification is "Large" based on its 104 ft. height

3. The spillway design flood, based on size and hazard classification, is the probable maximum flood (PMF).

Hydrologic and Hydraulic Analysis

1. Original Design Information - limited to statements in the Application Report and a letter to the designer from the State dated Dec. 26, 1962, and some calculation in files.

The spillway was designed to pass the 'C' curve criteria, 1590 cfs. Spillway capacity = 1590 cfs with H = 5.5 ft.

2. Evaluation of Features

Spillway Capacity - $Q = C L H^{3/2}$

L = 32 ft, field check from calculations in files.

C = 3.82 - judged acceptable

The minimum vertical distance between the weir crest and underside of bridge is 6.5 ft. Thus, at heads approaching 6.5 ft, the bridge will start to have an effect on spillway discharge

Peak PMF Inflow, QI

Information from Corps of Engineers, Balt. District, indicates the use of Trout Creek, D.A. = 8.05 mile^2 and an estimated peak PMF inflow of 10,100 cfs, as a comparable watershed.

$$Q_I = \left(\frac{1.15}{8.05}\right)^{0.8} 10,100 = 2130 \text{ cfs}$$

BY MEB DATE 9/2/78 SUBJECT Trout Run Hydrology / Hydraulics SHEET 5 OF 8

CHKD. BY DATE JOB No.

Volume of Runoff, V_I

PMP = 25.5 inches (TP-40)

$$V_I = \frac{\overset{\text{assume 90\% runoff}}{0.9 \cdot 25.5}}{12} \cdot 1.15 \cdot 640$$

$$= 1408 \text{ Ac-Ft}$$

Available flood storage V_S

Minimum V_S = surface area x height

$$= 42 \cdot H \text{ Ac-Ft}$$

Overtopping Potential is evaluated by use of short-cut flood routing, sheets 7 & 8

Required flood storage, V_R

$$V_R = (1 - \frac{Q_o}{Q_I}) V_I$$

at $H = 5.5$ ft

$Q_o = 1590$ cfs

$V_S = 231$ Ac-Ft. (min.)

$$V_R = (1 - \frac{1590}{2130}) 1408$$

$$= 357 \text{ Ac-Ft} \gg V_S$$

at $H = 6.0$

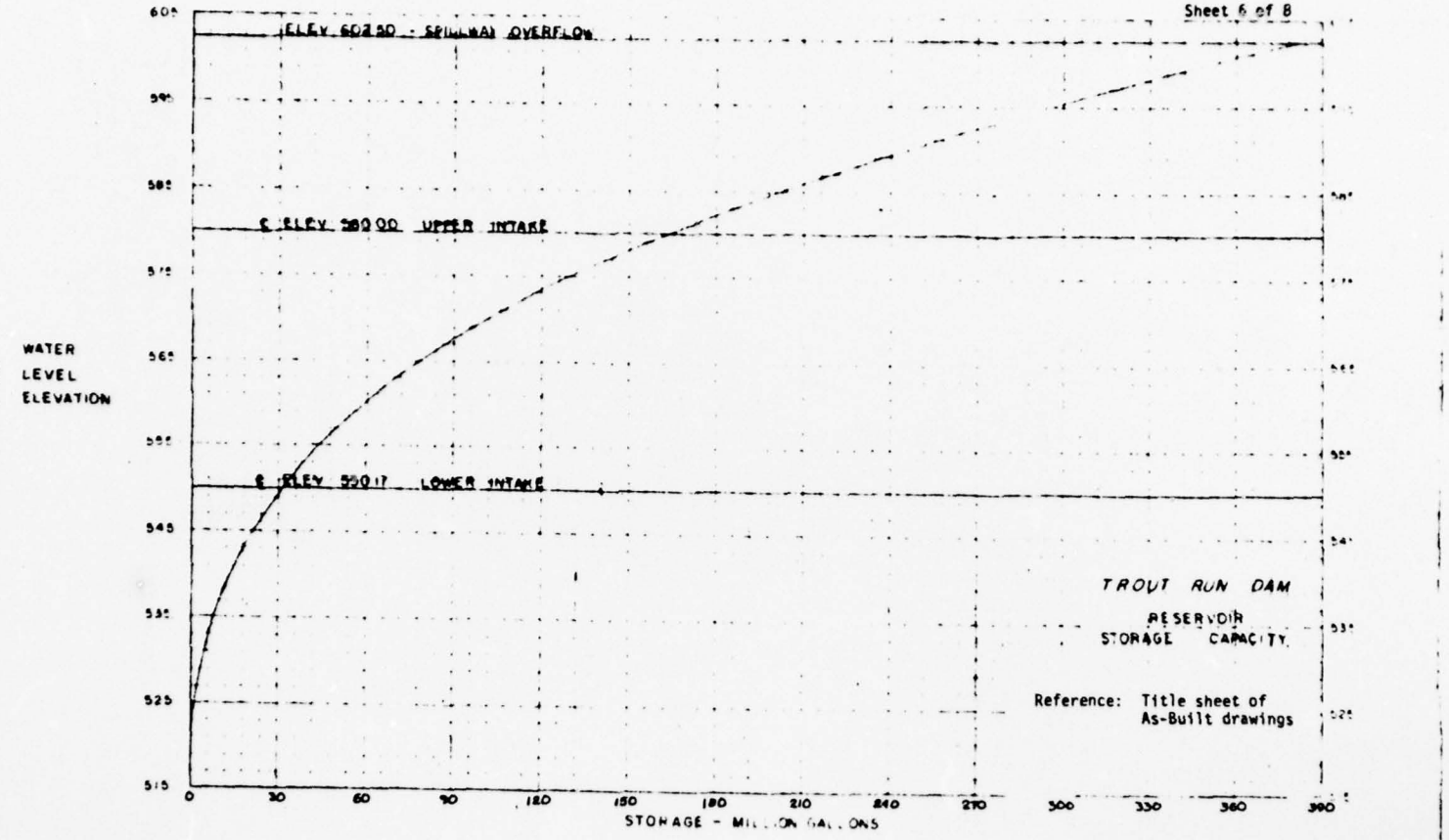
$$Q_o = 3.85 \cdot 32 \cdot 6^{3/2} = 1810 \text{ cfs}$$

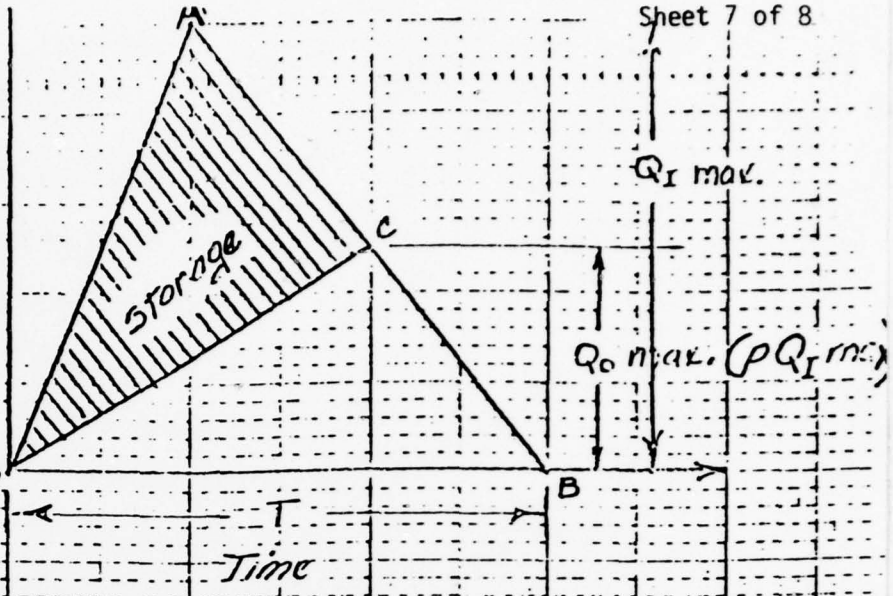
$V_S = 42 \cdot 6 = 252$ Ac-Ft (min.)

$$V_R = (1 - \frac{1810}{2130}) 1408$$

$$= 211 < V_S$$

Therefore, the spillway is rated as "Adequate".


ELEV 602.50 - SPILLWAY OVERFLOW
℄ ELEV 580.00 UPPER INTAKE
℄ ELEV 550.17 LOWER INTAKE
WATER LEVEL ELEVATION
TROUT RUN DAM
RESERVOIR STORAGE CAPACITY
Reference: Title sheet of As-Built drawings
0
30
60
90
120
150
180
210
240
270
300
330
360
390
STORAGE - MILLION GALLONS



PURPOSE: Establish relationship between maximum spillway discharge and storage required to pass flood hydrograph without exceeding maximum pool level.

$$\frac{\Delta AOC}{\Delta AOB} = \frac{\Delta AOB - \Delta COB}{\Delta AOB} = 1 - \frac{\Delta COB}{\Delta AOB}$$

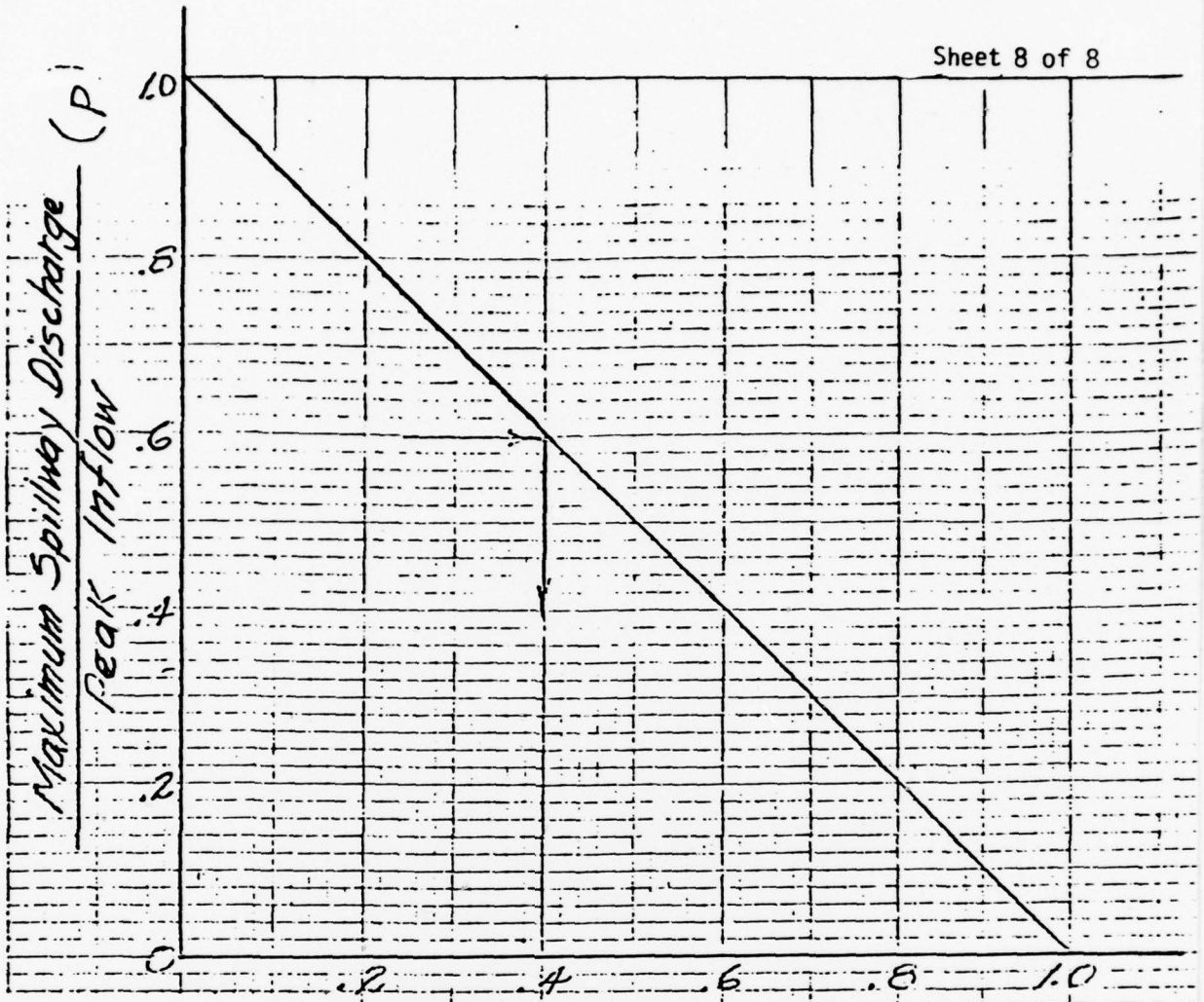
$$\frac{\Delta AOC}{\Delta AOB} = 1 - \frac{T \rho Q_I \text{ max}/2}{T\ Q_I \text{ max}/2} = 1 - \rho$$

$$\Delta AOC = (1-\rho)\,\Delta AOB \quad \text{where } 0 \le \rho \le 1.0$$

ρ	ΔAOC
1.00	0
0.75	0.25 ΔAOB
0.50	0.50 ΔAOB
0.25	0.75 ΔAOB
0	1.00 ΔAOB

REFERENCE

PRELIMINARY ENGINEER TECHNICAL LETTER NO. 1110-2-
25 January 1978

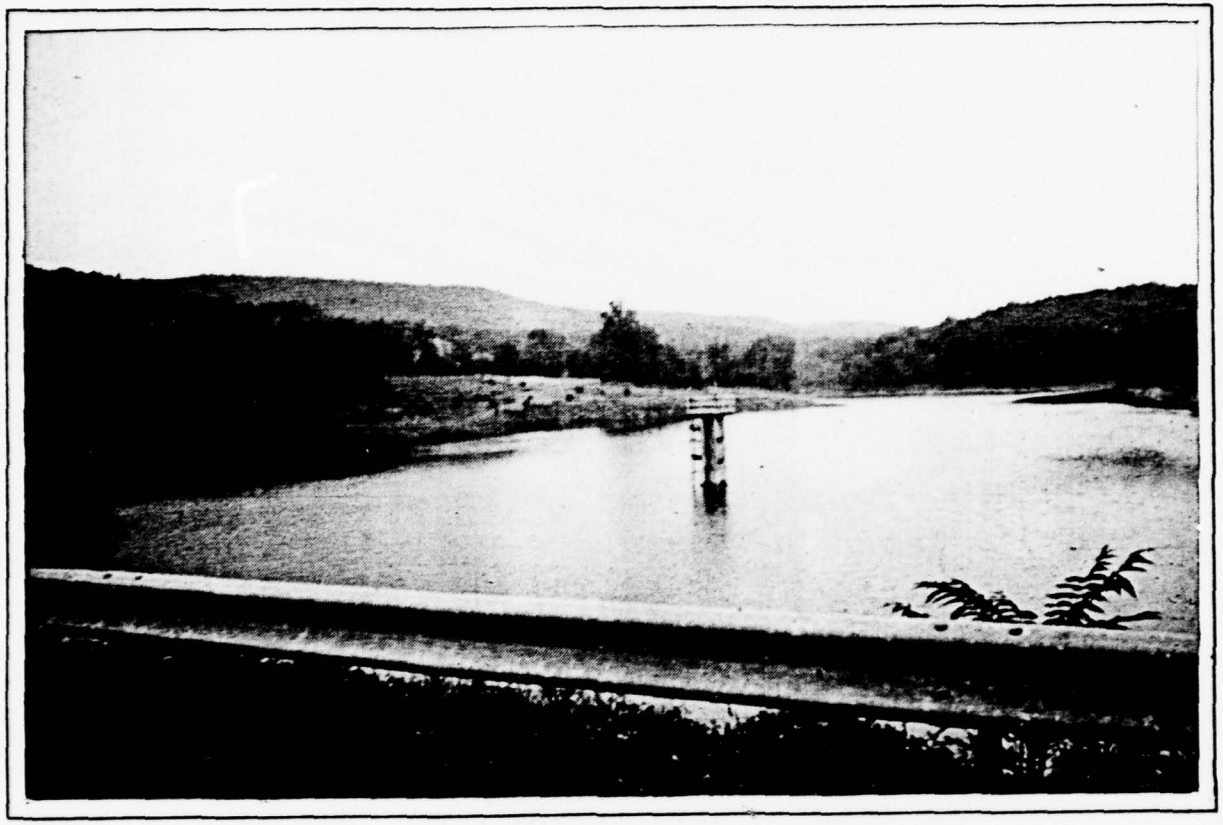


Steps to obtain required reservoir to pass inflow hydrograph without overtopping dam.

1. Obtain maximum spillway discharge
2. Develop inflow hydrograph
3. Compute relationship of maximum spillway capacity to peak inflow
4. Read relationship of required reservoir storage to volume of inflow hydrograph from curve

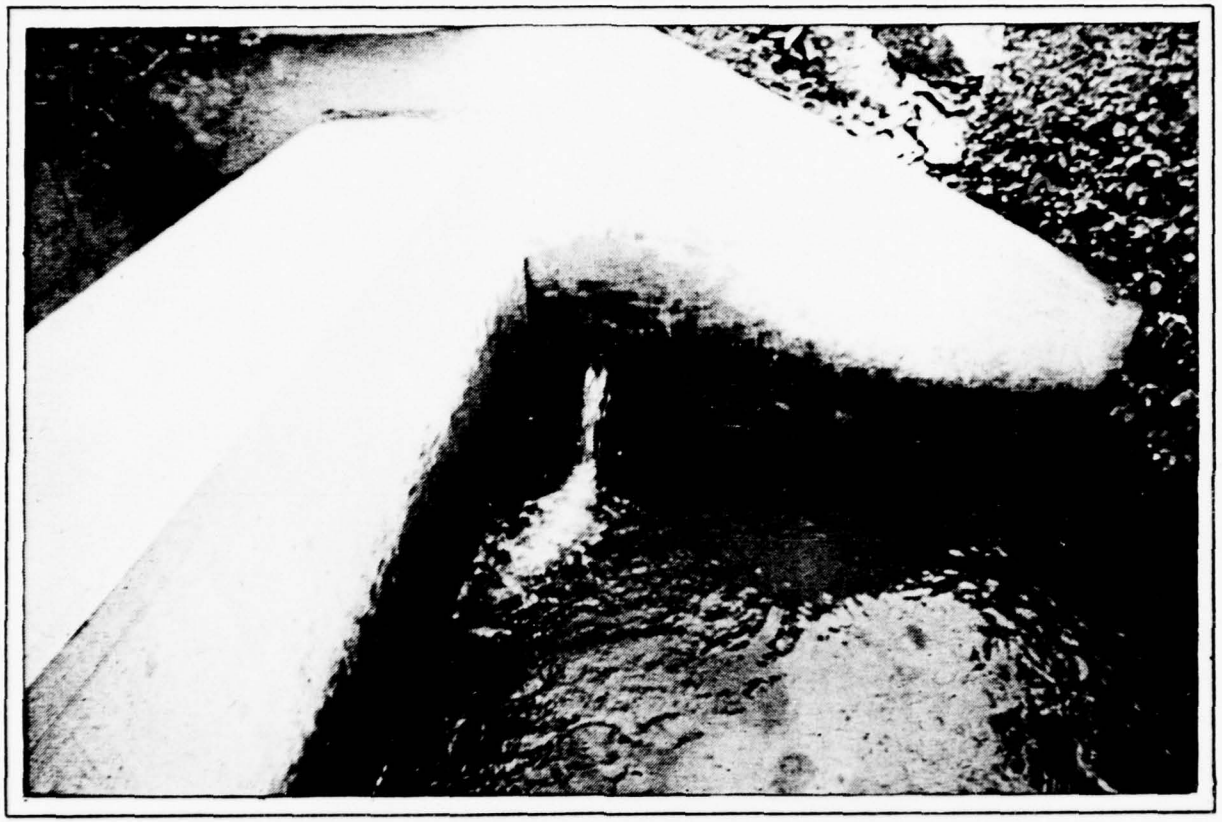
APPENDIX

D



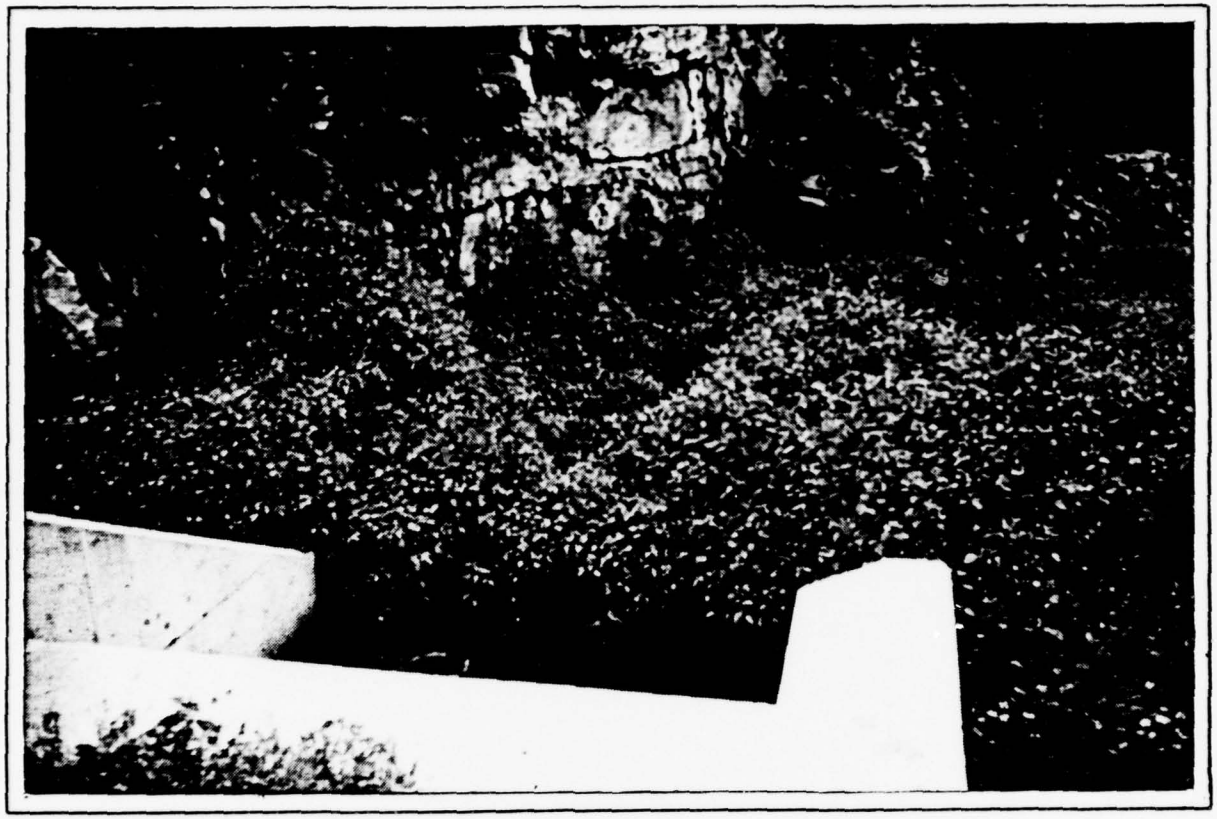
WATER SUPPLY INTAKE TOWER.

PHOTOGRAPH NO. 1



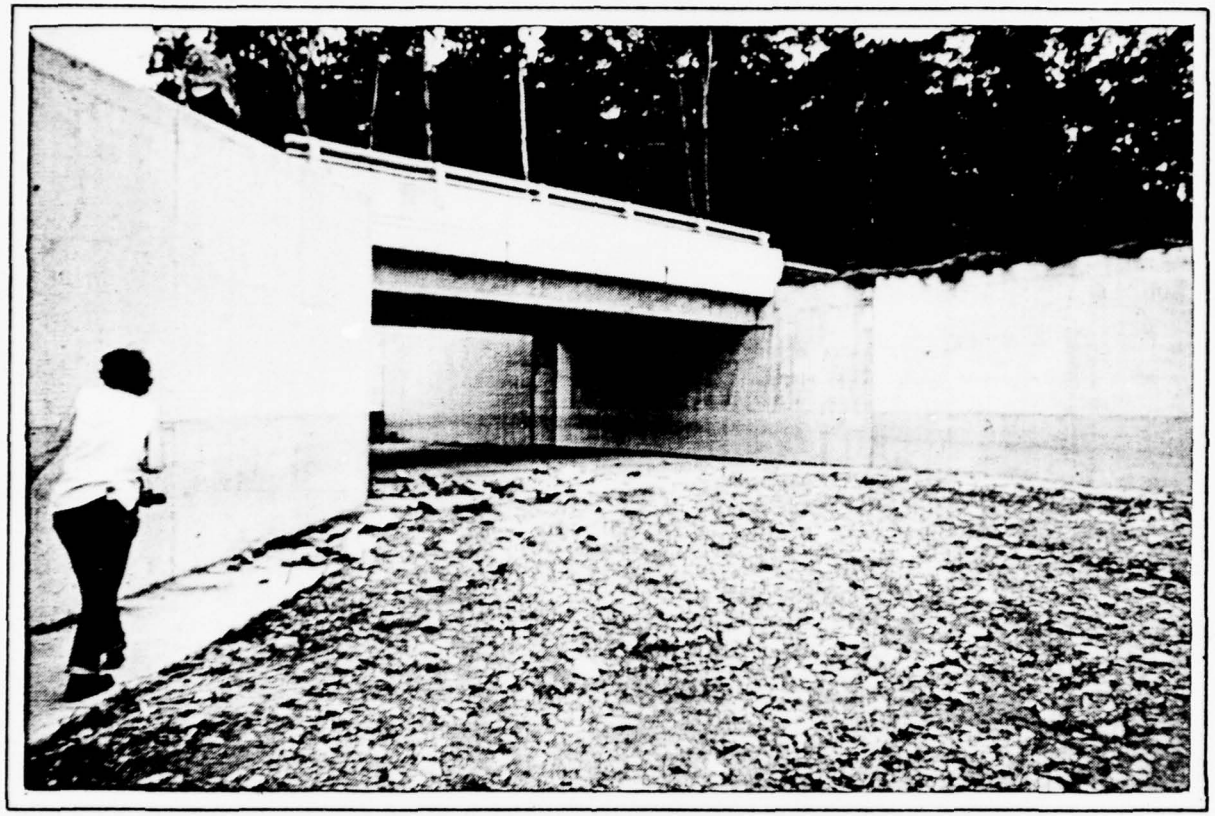
POND DRAIN IMPACT BASIN. NOTE
MINIMUM WATER SUPPLY RELEASE
PIPE OUTLET.

PHOTOGRAPH NO. 2



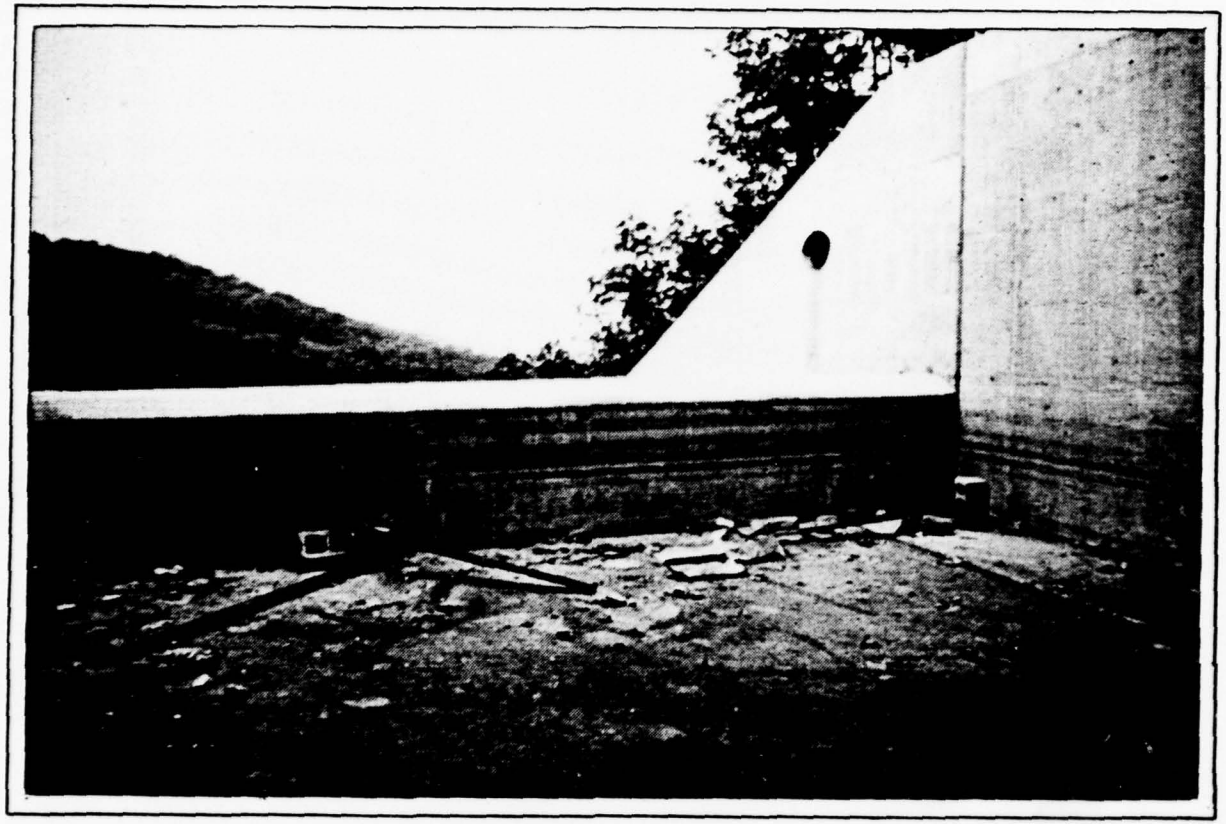
DOWNSTREAM CHANNEL BELOW IMPACT
BASIN.

PHOTOGRAPH NO. 3



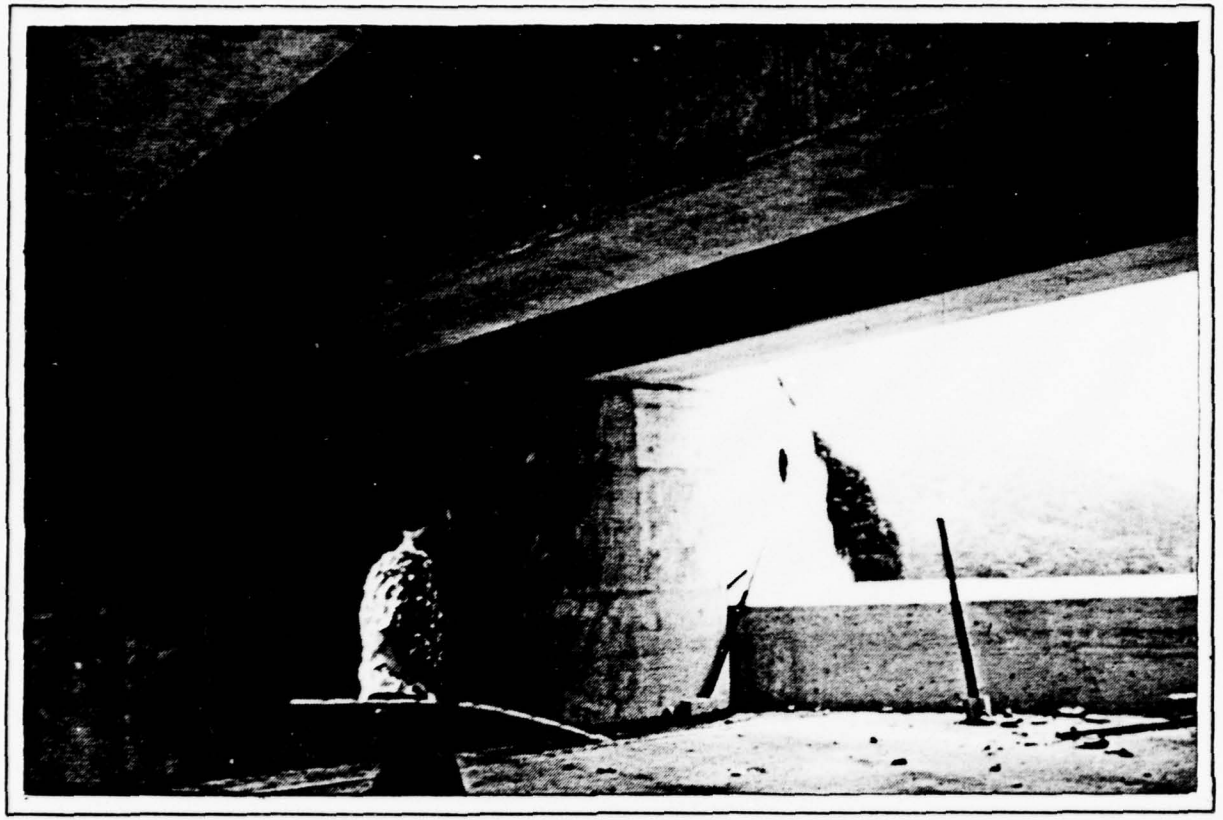
SPILLWAY APPROACH CHANNEL.

PHOTOGRAPH NO. 4



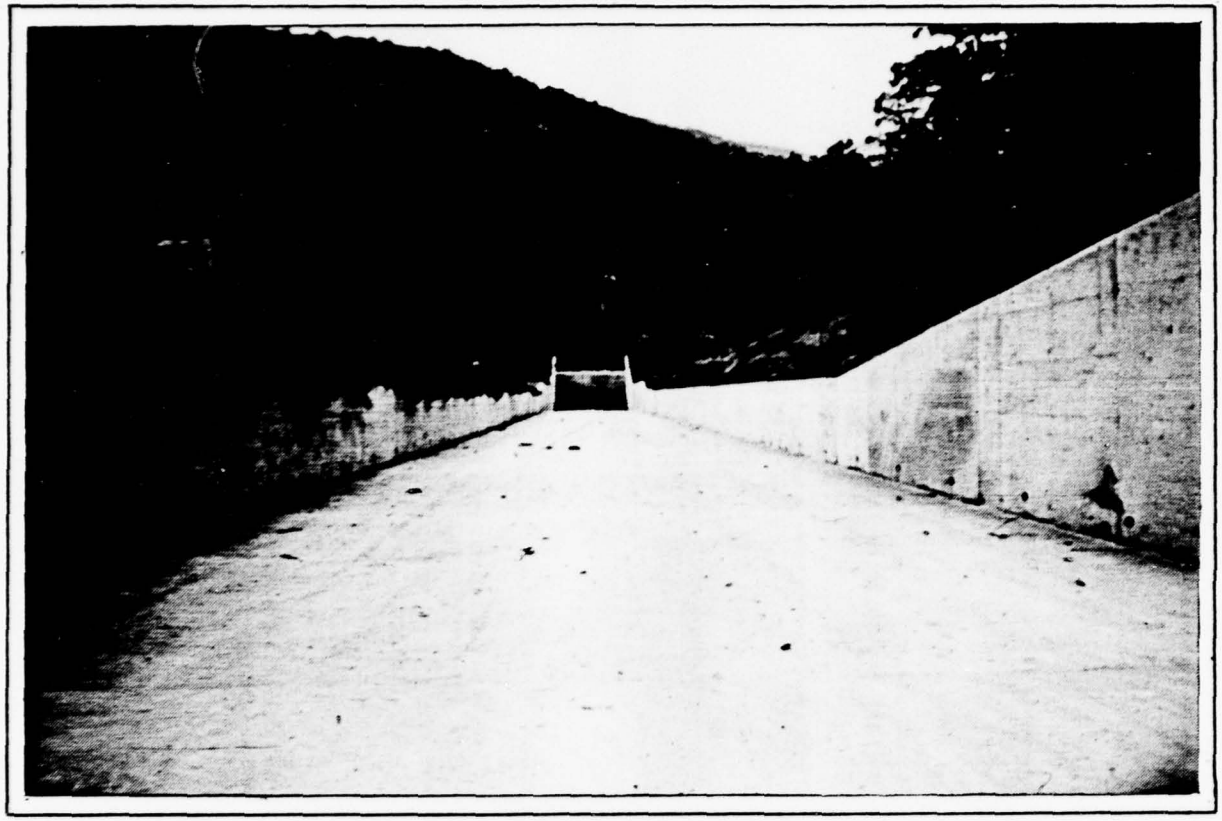
VIEW OF SPILLWAY OGEE SECTION.

PHOTOGRAPH NO. 5



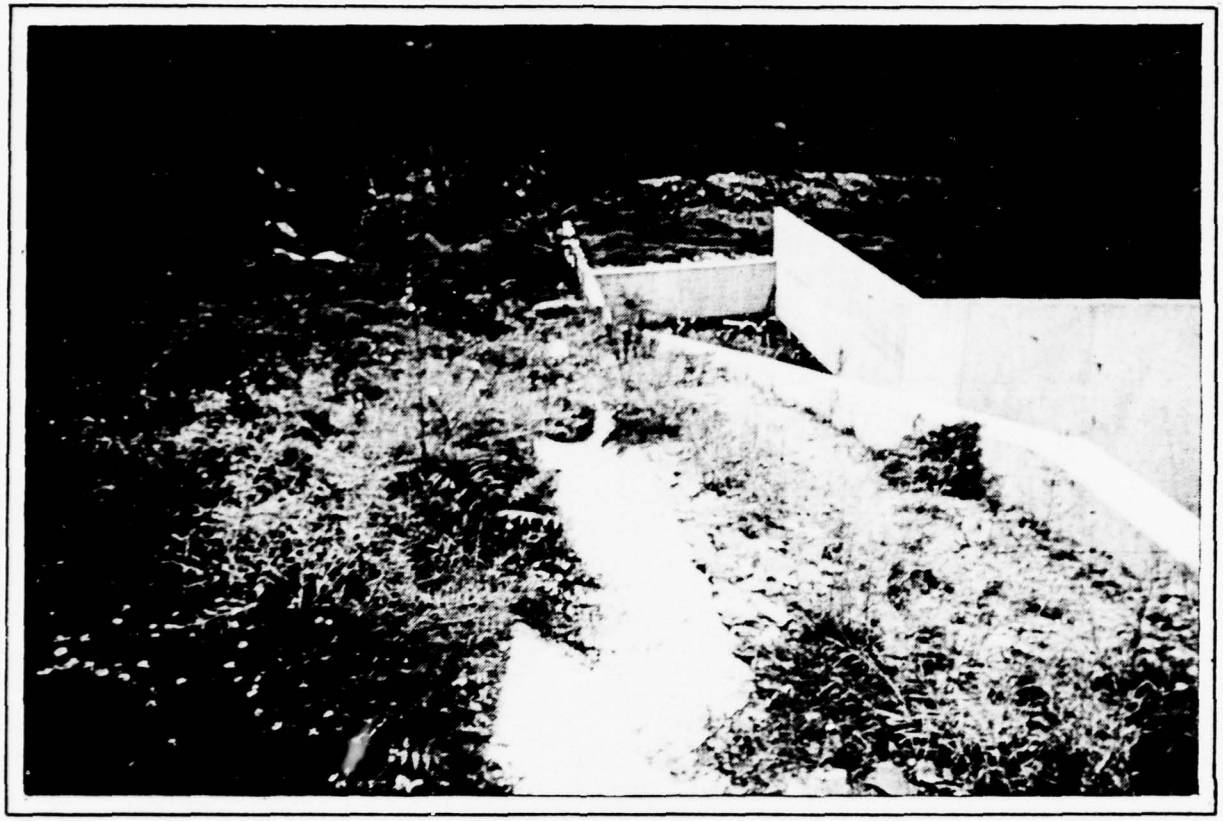
VIEW OF SPILLWAY. NOTE
CLEARANCE BETWEEN BRIDGE
AND OGEE SECTION.

PHOTOGRAPH NO. 6



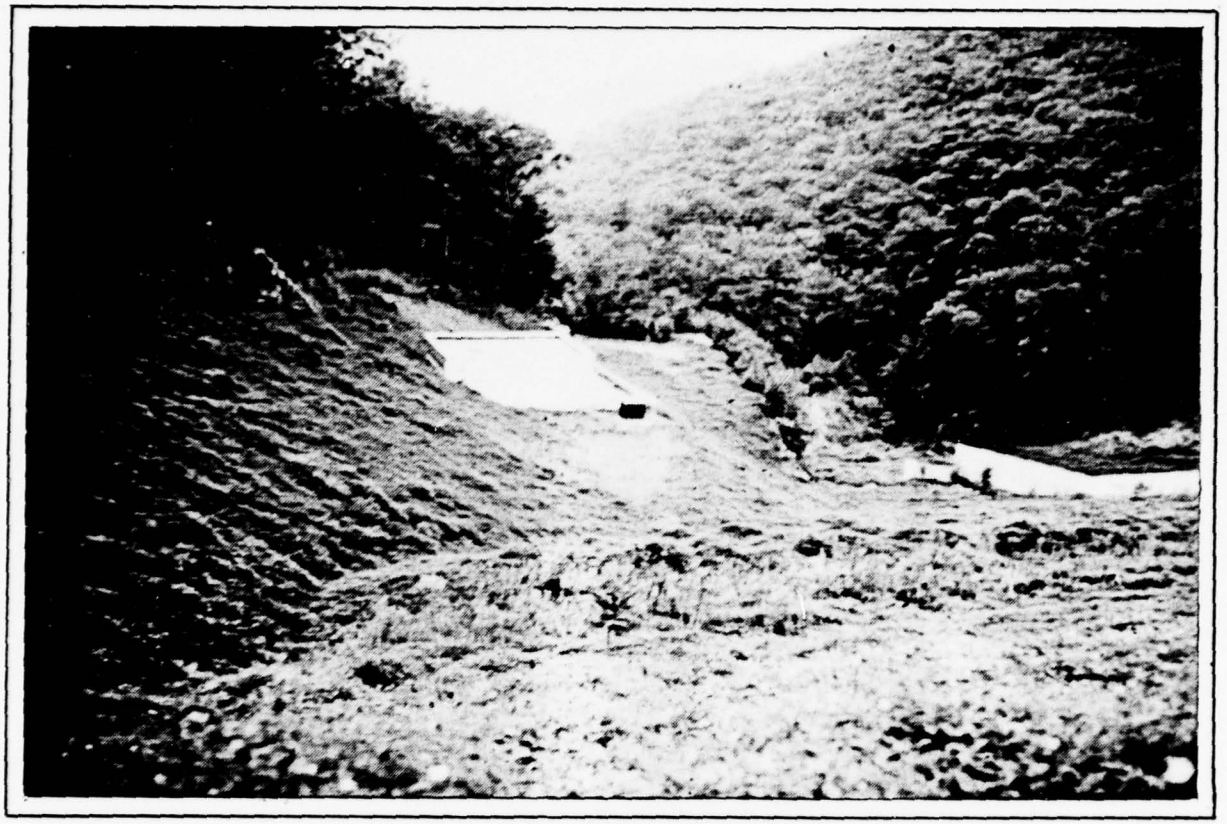
SPILLWAY DISCHARGE CHUTE
AND STILLING BASIN.

PHOTOGRAPH NO. 7



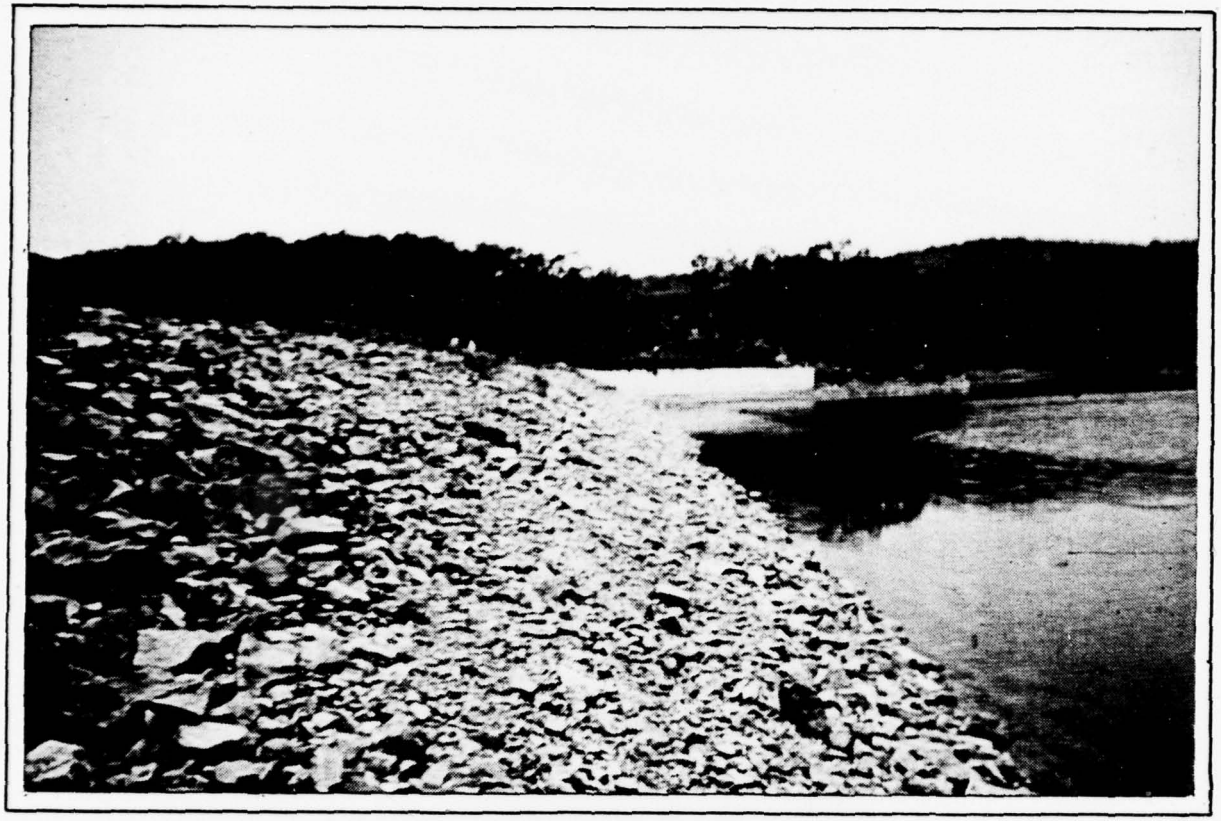
OVERVIEW OF DOWNSTREAM TOE.

PHOTOGRAPH NO. 8



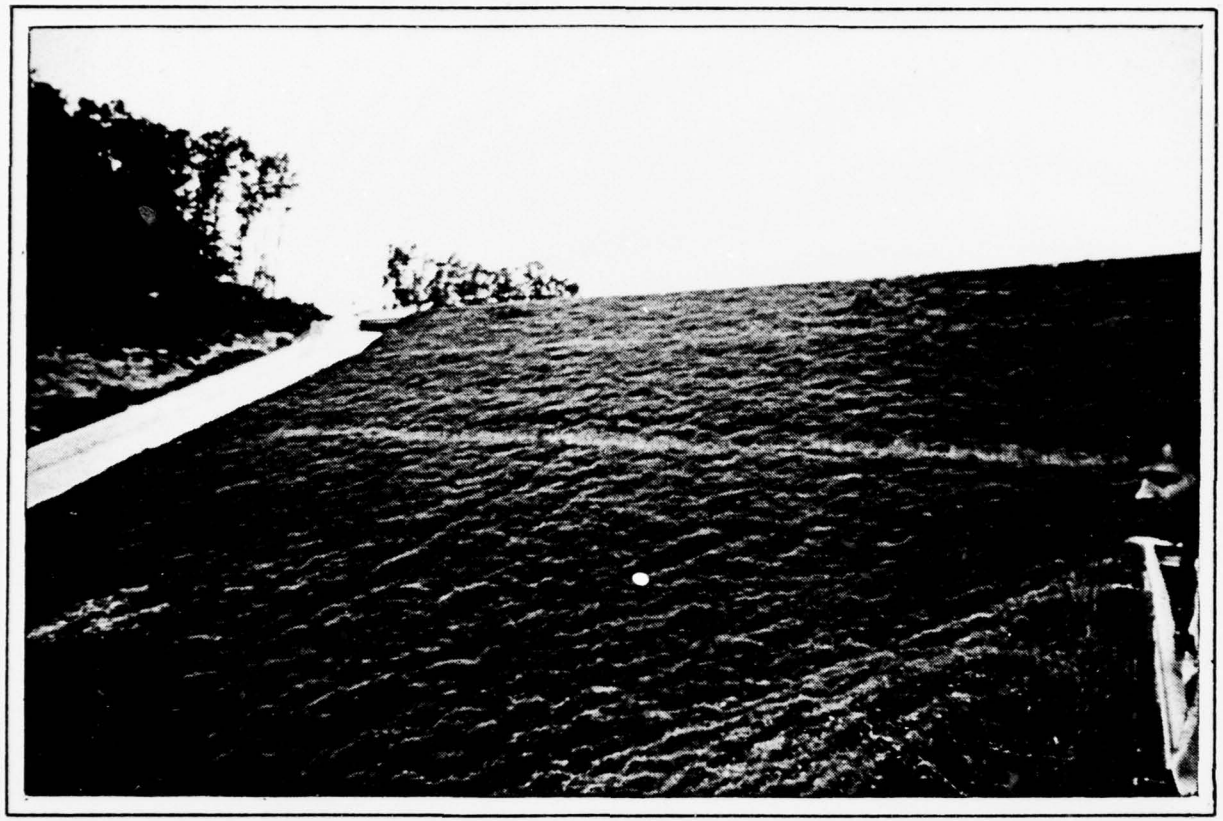
OVERVIEW OF PUMPHOUSE AND
DOWNSTREAM CONDITIONS.

PHOTOGRAPH NO. 9



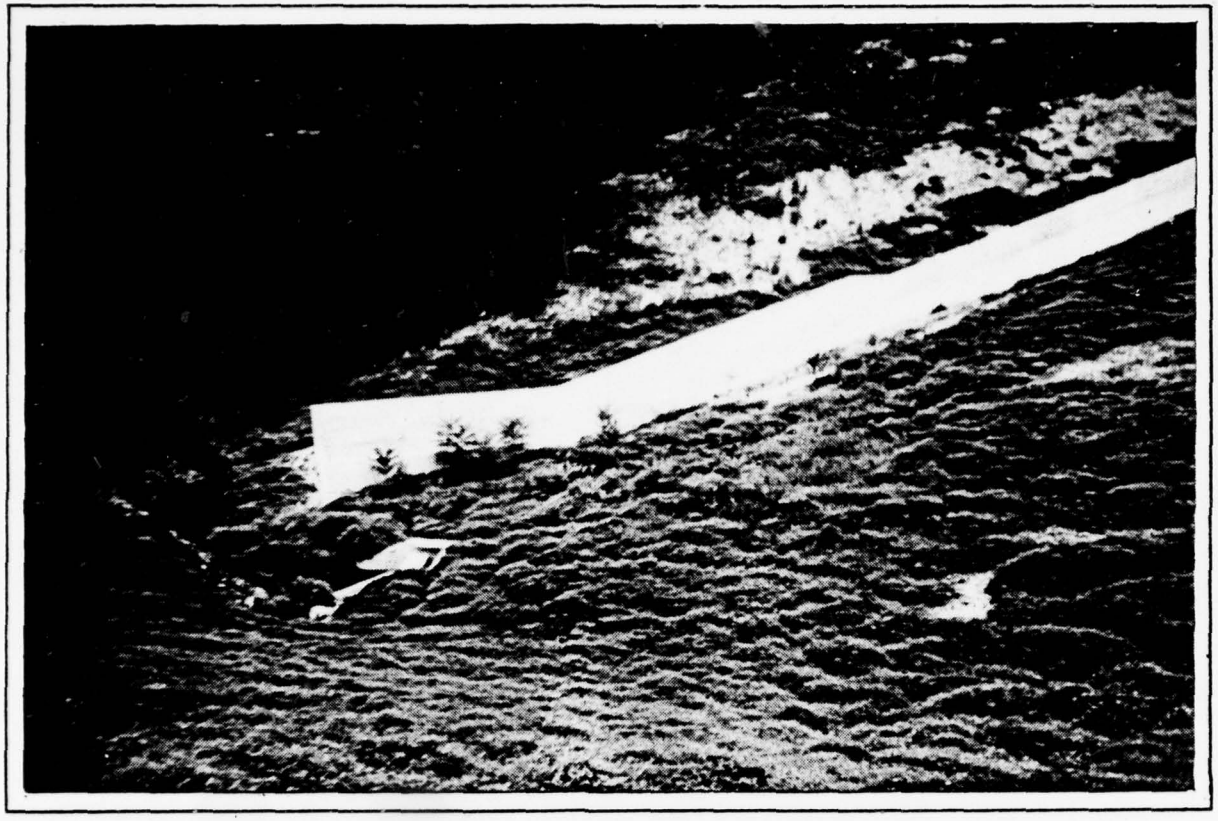
VIEW OF UPSTREAM SLOPE LOOKING
TOWARDS RIGHT ABUTMENT.

PHOTOGRAPH NO. 10



VIEW OF DOWNSTREAM SLOPE. NOTE BENCH ACROSS MIDDLE OF PHOTOGRAPH AND SEEPAGE ZONE IN LOWER LEFT CORNER.

PHOTOGRAPH NO. 11

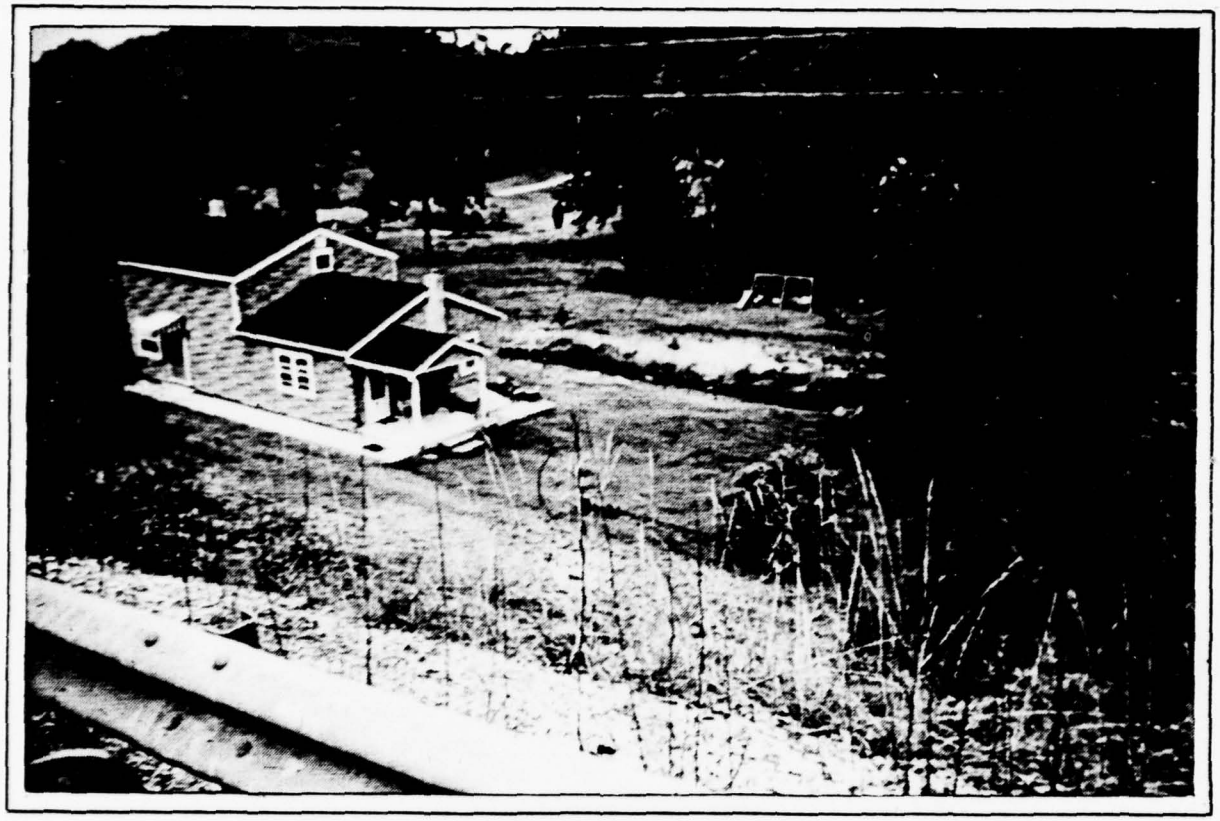


NOTE SEEPAGE ZONE ON DOWNSTREAM
SLOPE BY DIFFERENCES IN VEGETATION.

PHOTOGRAPH NO. 12

CLOSE-UP VIEW OF SEEPAGE
DESCRIBED IN PHOTOGRAPH NO. 12

PHOTOGRAPH NO. 13

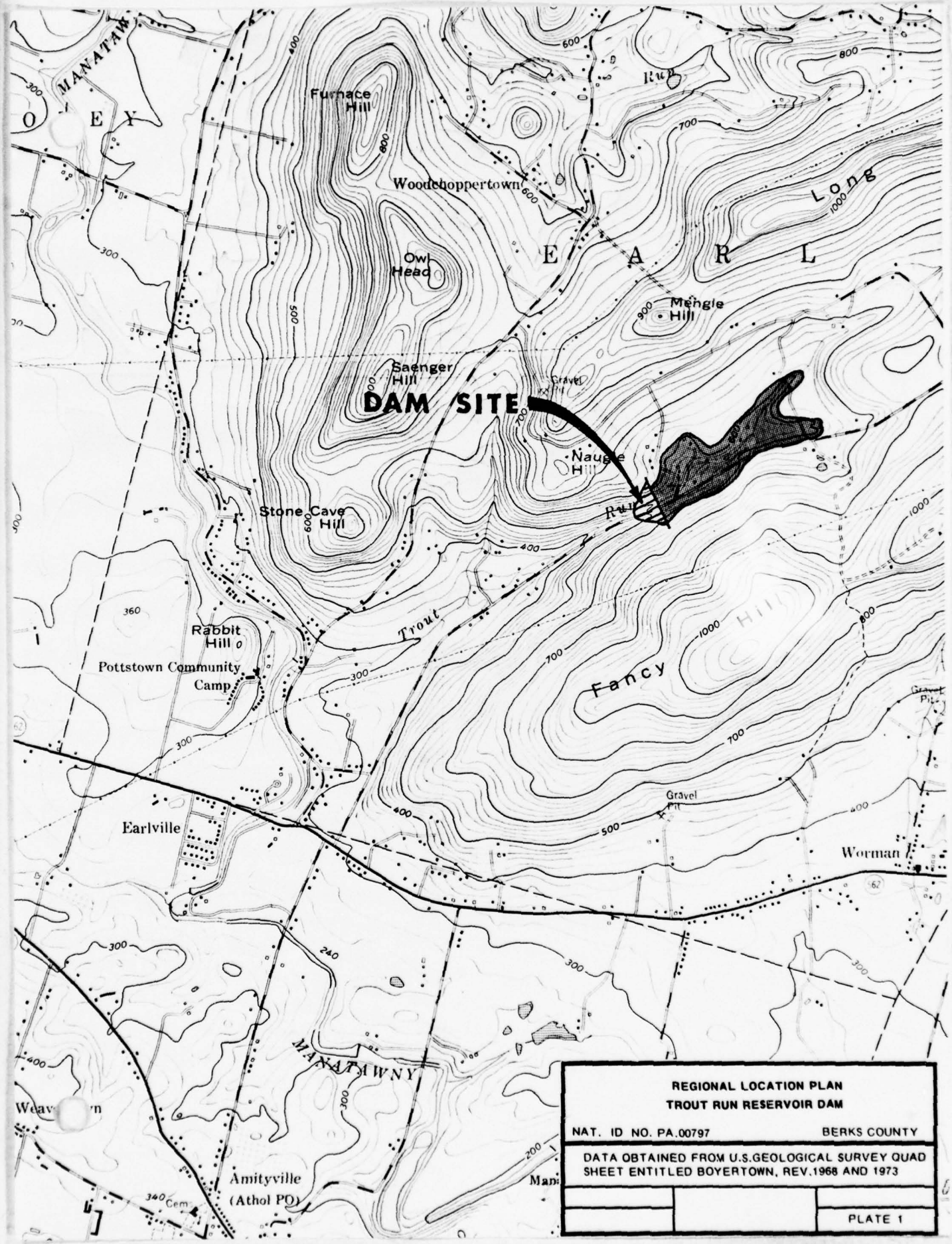


TYPICAL VIEW OF DOWNSTREAM CONDITIONS.
NOTE CREEK BEHIND HOUSE.

PHOTOGRAPH NO. 14

APPENDIX

E

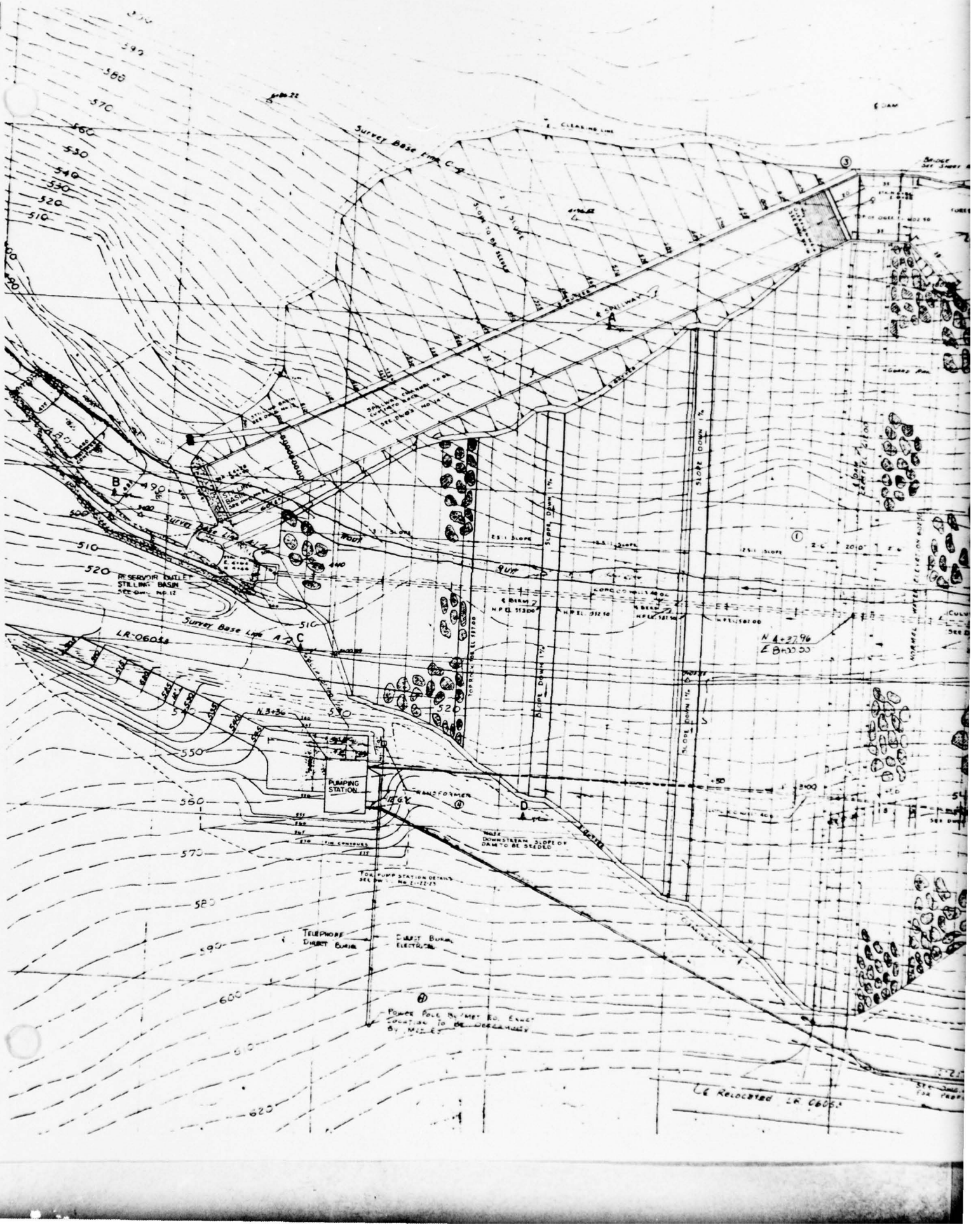


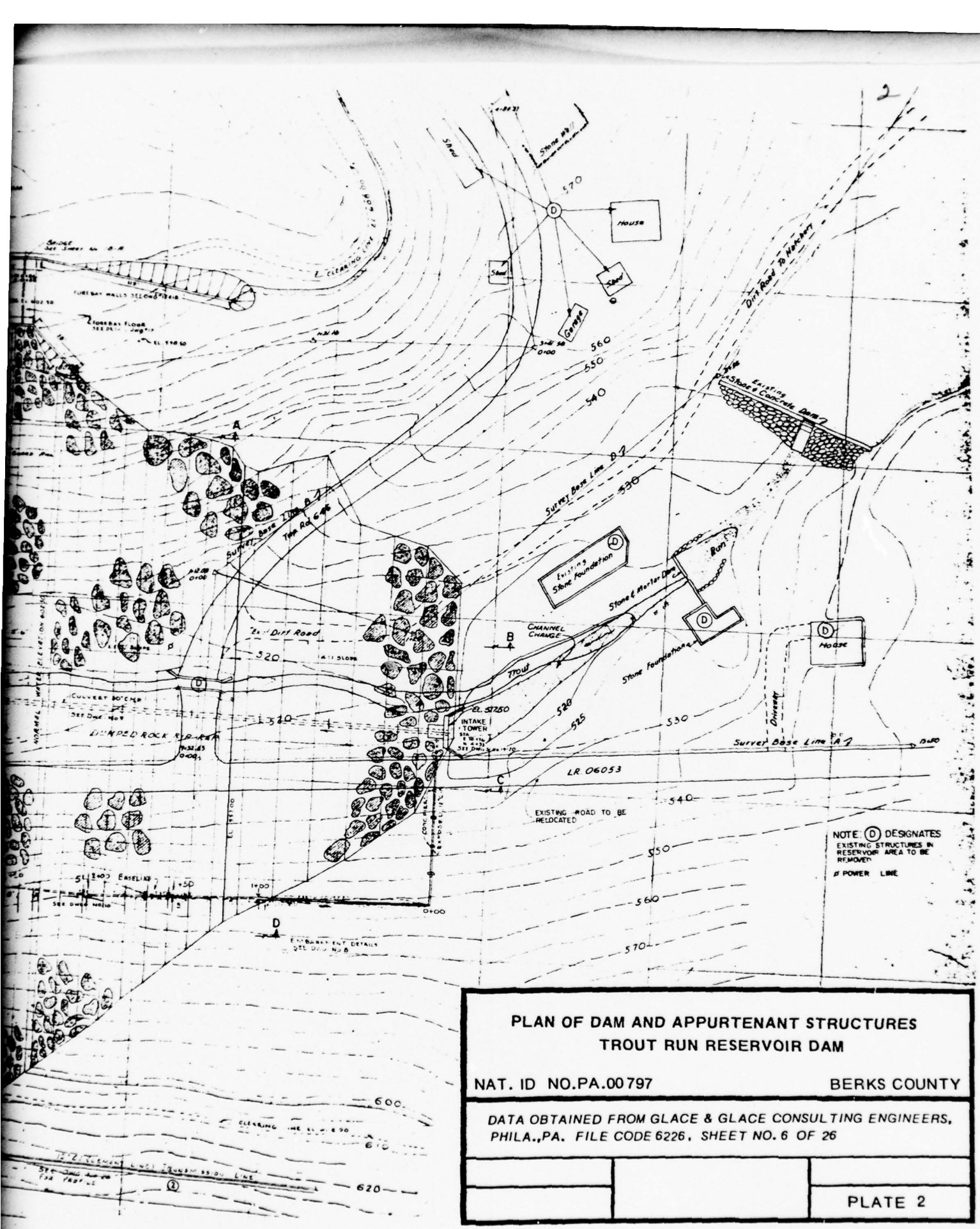
REGIONAL LOCATION PLAN
TROUT RUN RESERVOIR DAM

NAT. ID NO. PA.00797 BERKS COUNTY

DATA OBTAINED FROM U.S.GEOLOGICAL SURVEY QUAD SHEET ENTITLED BOYERTOWN, REV.1968 AND 1973

PLATE 1


Survey Base Line C-2
Survey Base Line A-2
Survey Base Line B-2
RESERVOIR OUTLET STILLING BASIN
SEE DWG. NO. 12
LR-06065
PUMPING STATION
TRANSFORMER
TELEPHONE DIRECT BURIAL
DIRECT BURIAL ELECTRICAL
POWER POLE
SLOPE DOWN 1%
SLOPE DOWN 2%
N 4+27.96
E 8430.00
L6 RELOCATED LR 06065

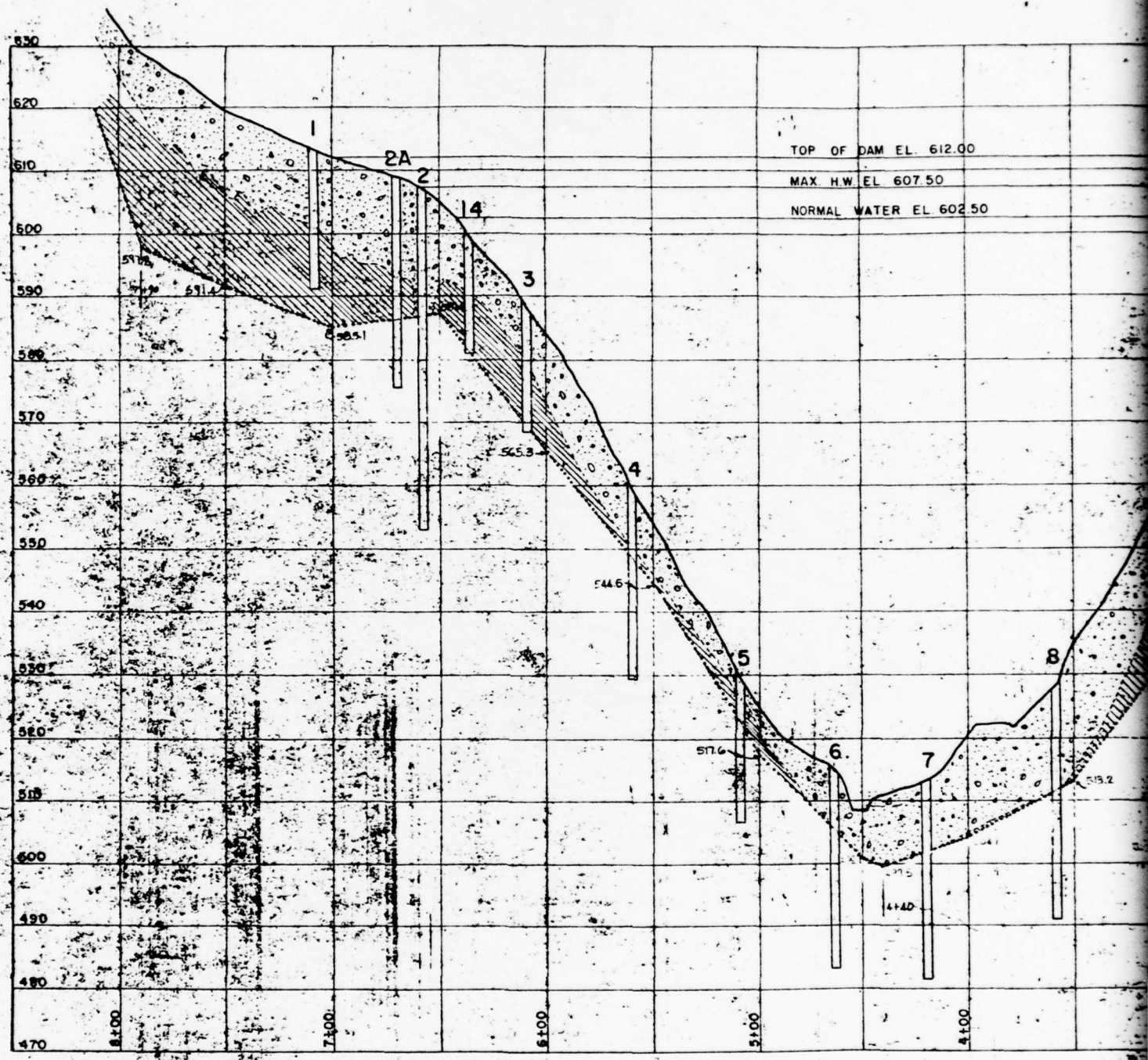


PLAN OF DAM AND APPURTENANT STRUCTURES
TROUT RUN RESERVOIR DAM

NAT. ID NO.PA.00797 BERKS COUNTY

DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226, SHEET NO. 6 OF 26

PLATE 2



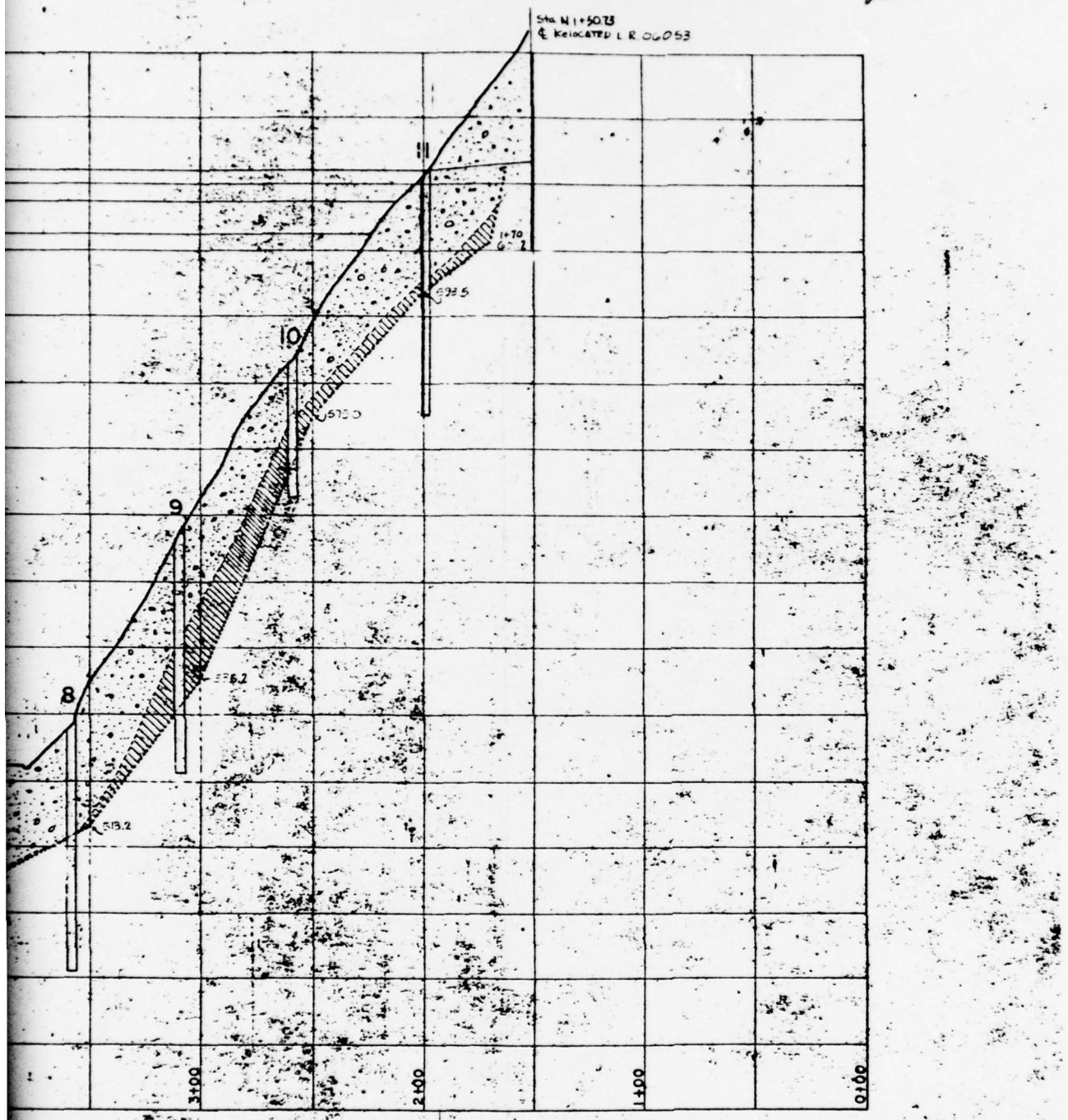
℄ PROFILE AT SITE OF DAM
STATION 8+00

OVERBURDEN

EXCAVATABLE, HIGHLY FRACTURED BEDROCK

BASE OF CUTOFF TRENCH

2



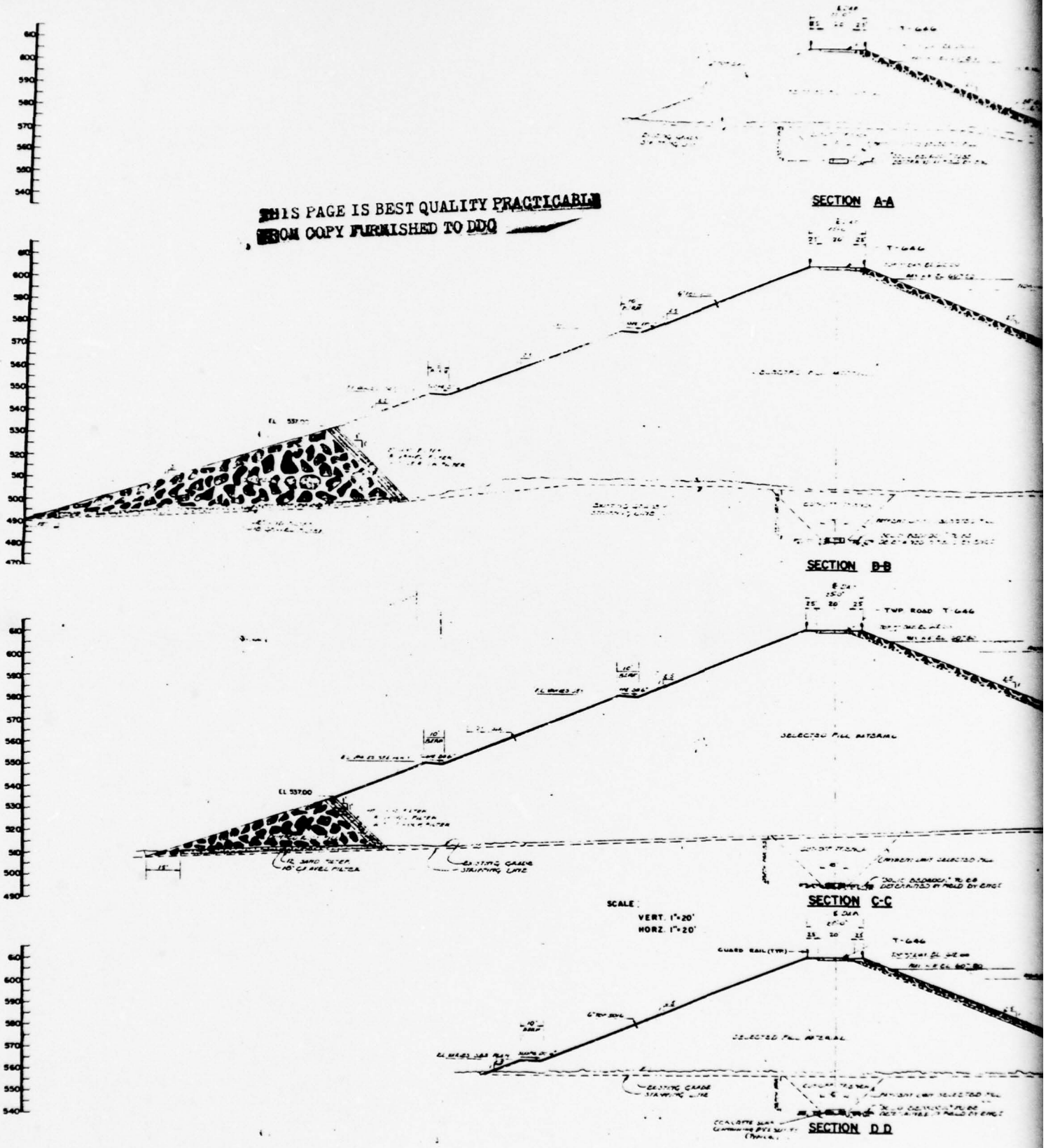
OF DAM
0

CENTERLINE PROFILE
TROUT RUN RESERVOIR DAM

NAT. ID NO.PA.00797 BERKS COUNTY

DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226, SHEET NO. 7 OF 26

PLATE 3



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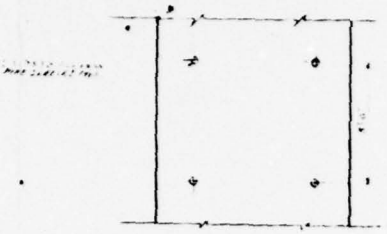
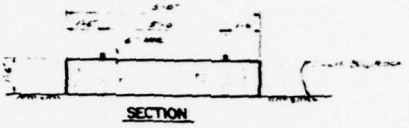
SECTION A-A



PLAN

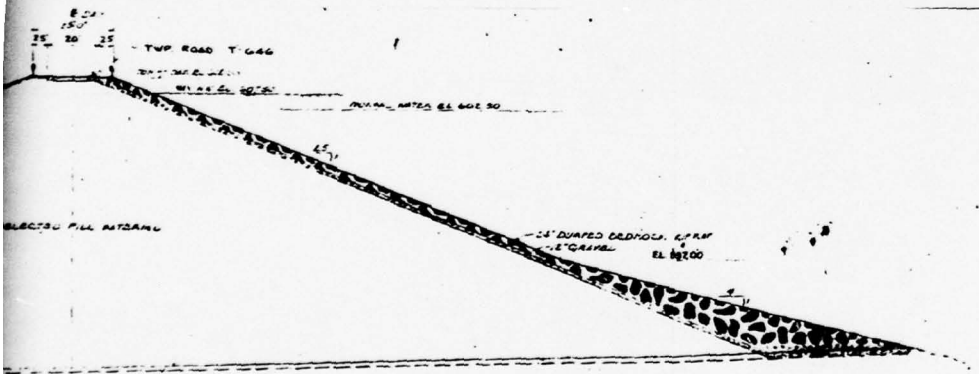


SECTION

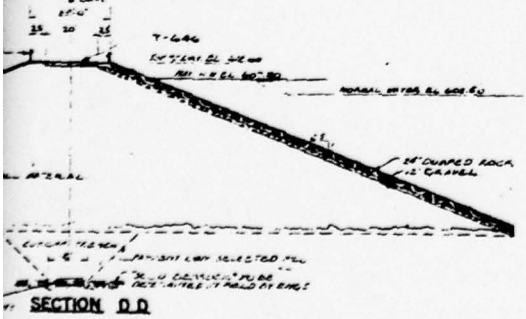
CONCRETE BASE FOR CORE DRILLING

SCALE 3/8" = 1'-0"

SECTION B-B

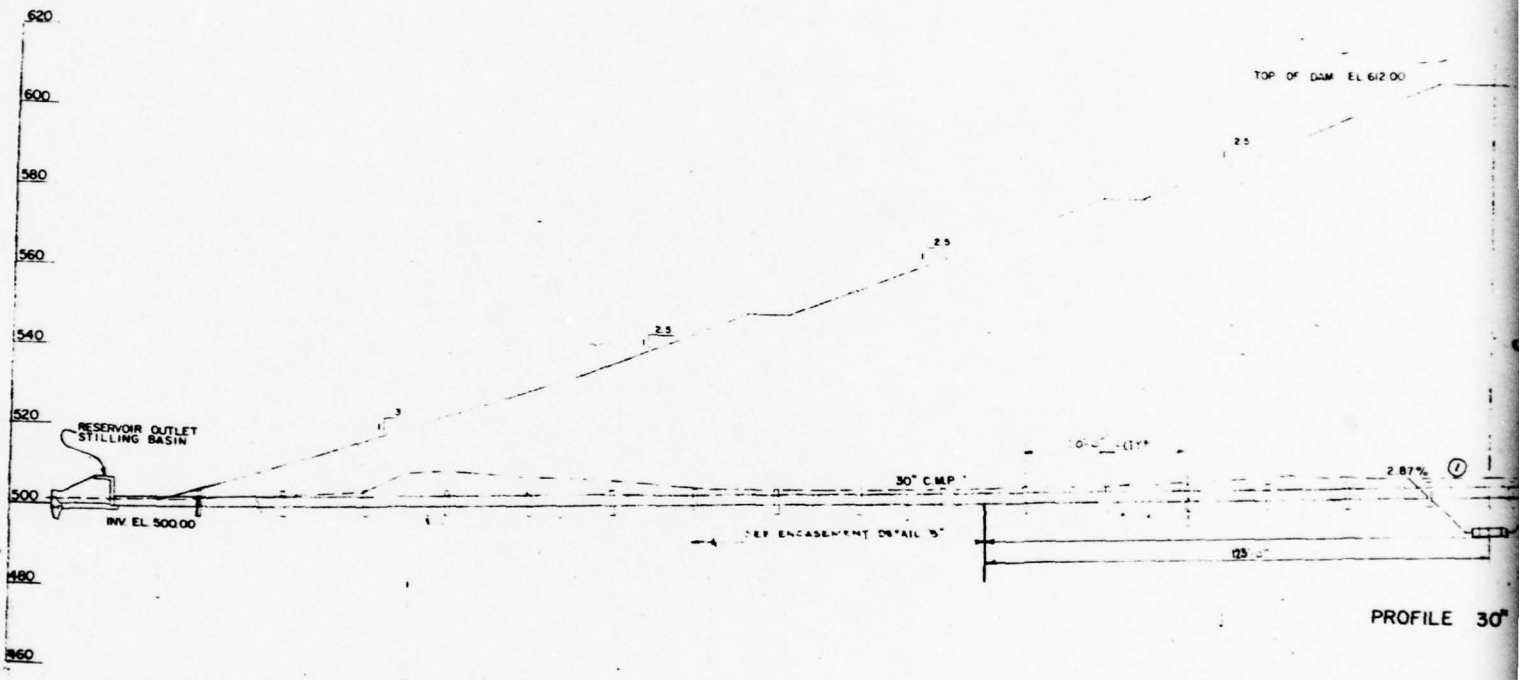


SECTION C-C



SECTION D-D

TYPICAL EMBANKMENT SECTIONS TROUT RUN RESERVOIR DAM		
NAT. ID NO.PA.00797		BERKS COUNTY
DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226, SHEET NO. 8 OF 26		
		PLATE 4



PROFILE 30"

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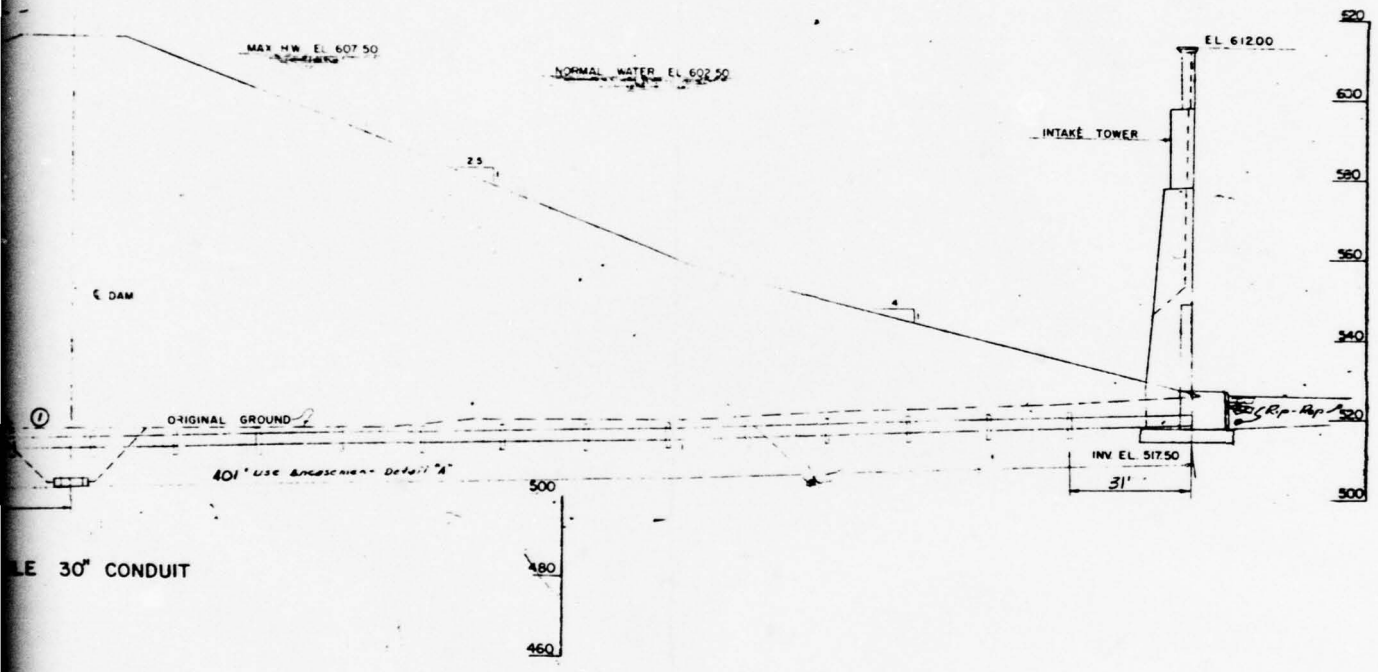
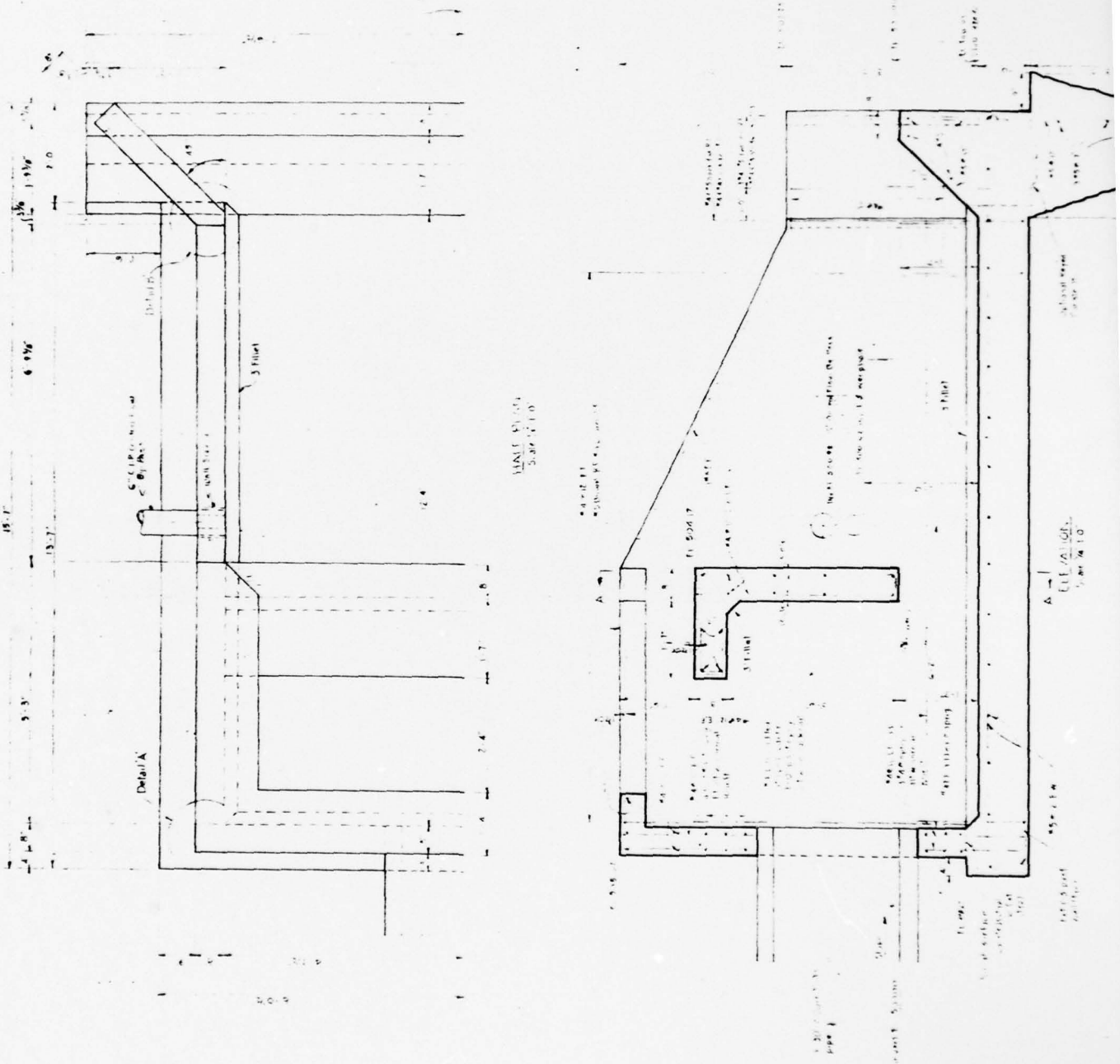


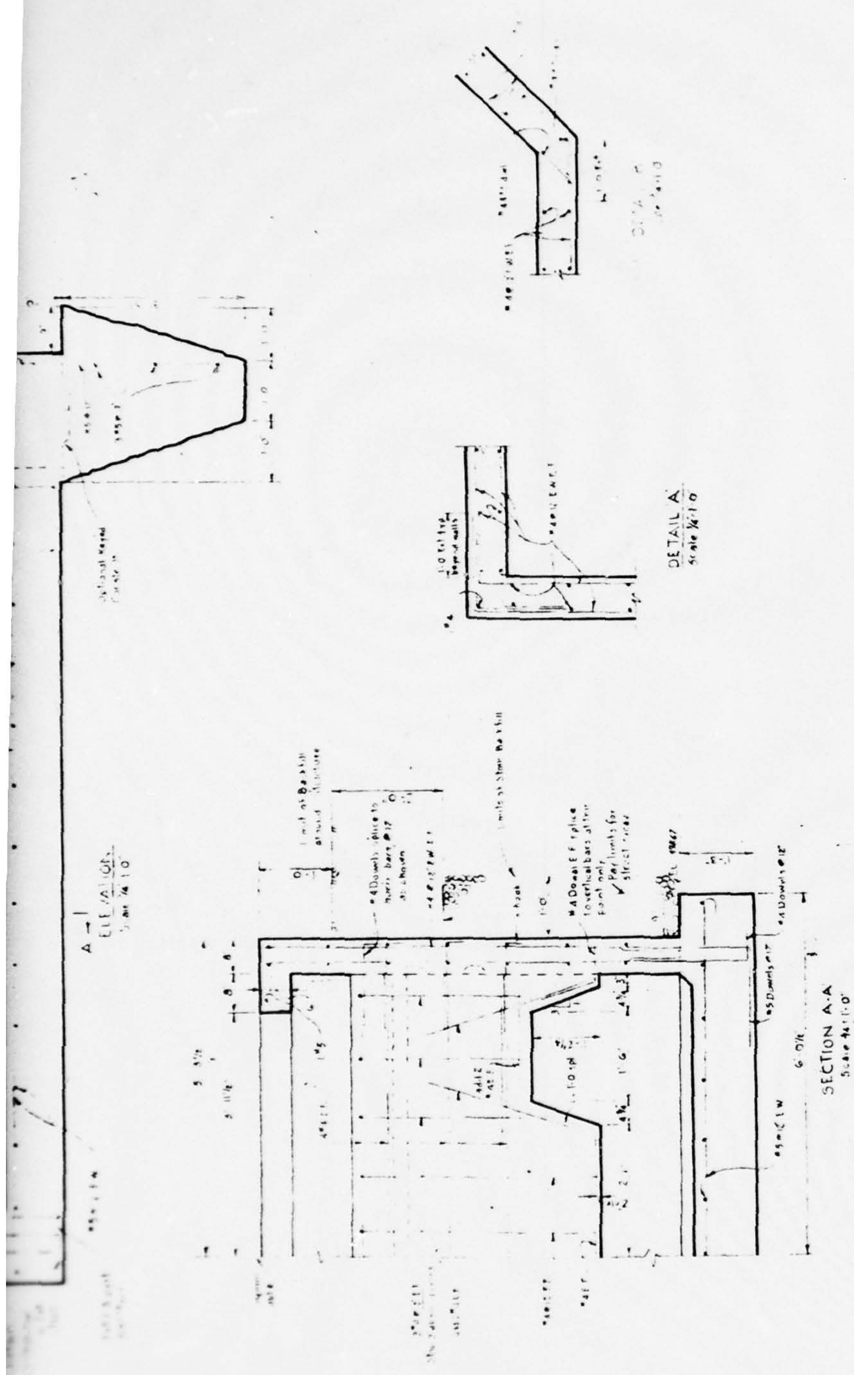
POND DRAIN PROFILE
TROUT RUN RESERVOIR DAM

NAT. ID NO.PA.00797 BERKS COUNTY

DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226, SHEET NO. 9 OF 26

PLATE 5



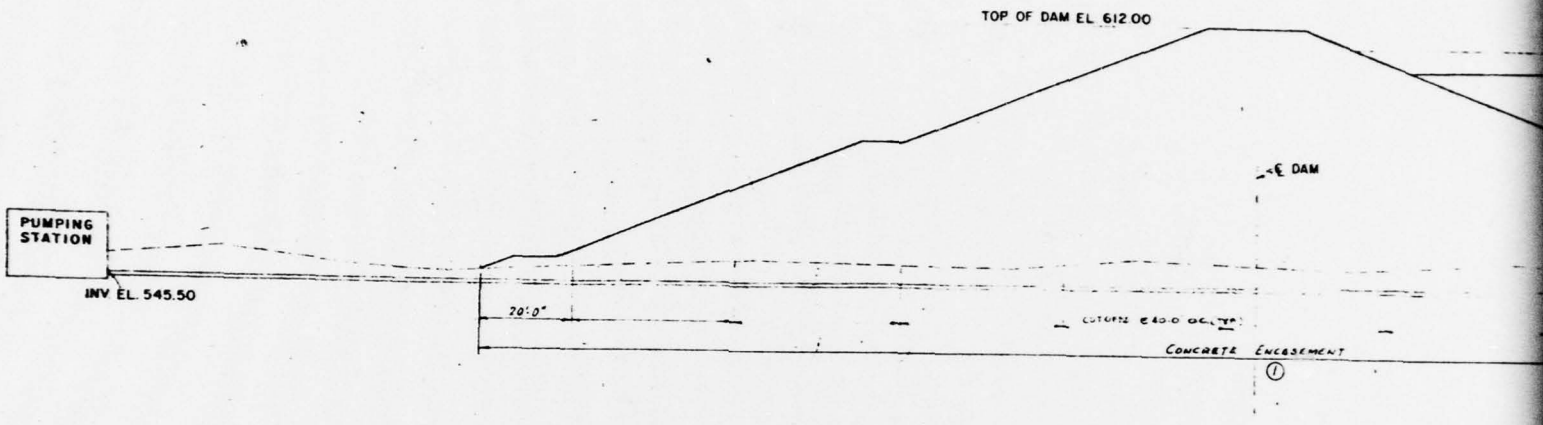


DETAILS OF IMPACT BASIN
TROUT RUN RESERVOIR DAM

NAT. ID NO.PA.00797 BERKS COUNTY

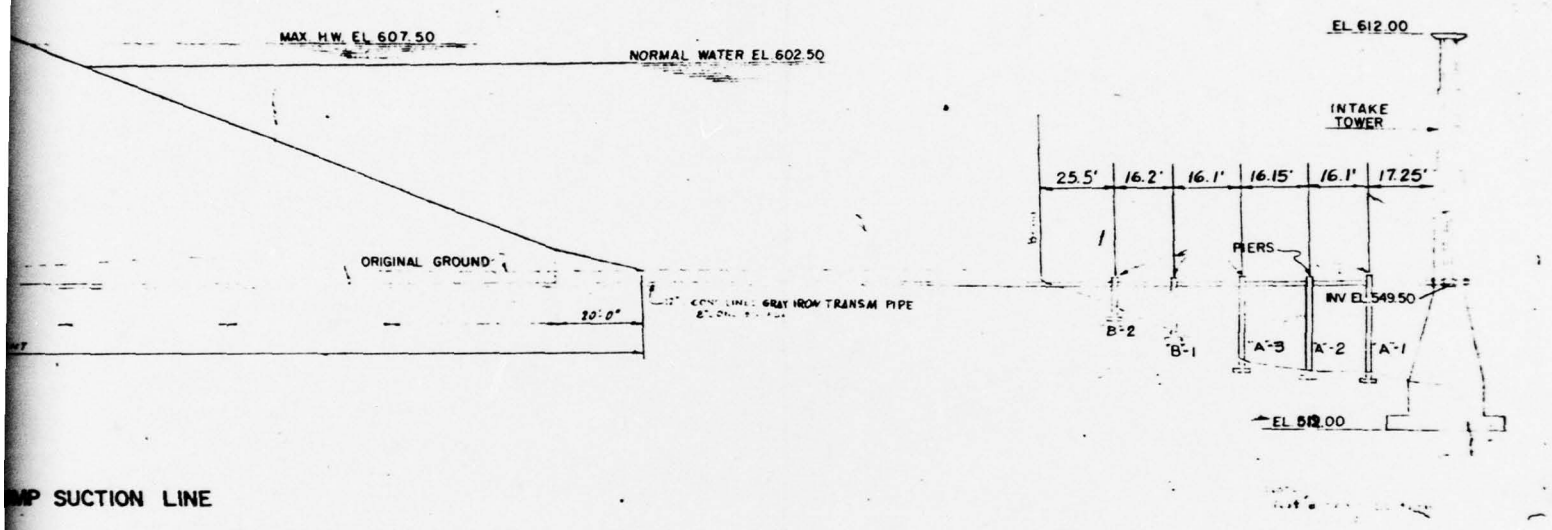
DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226, SHEET NO.12 OF 26

PLATE 6



PROFILE 12"C.I. PUMP SUCTION LINE

2



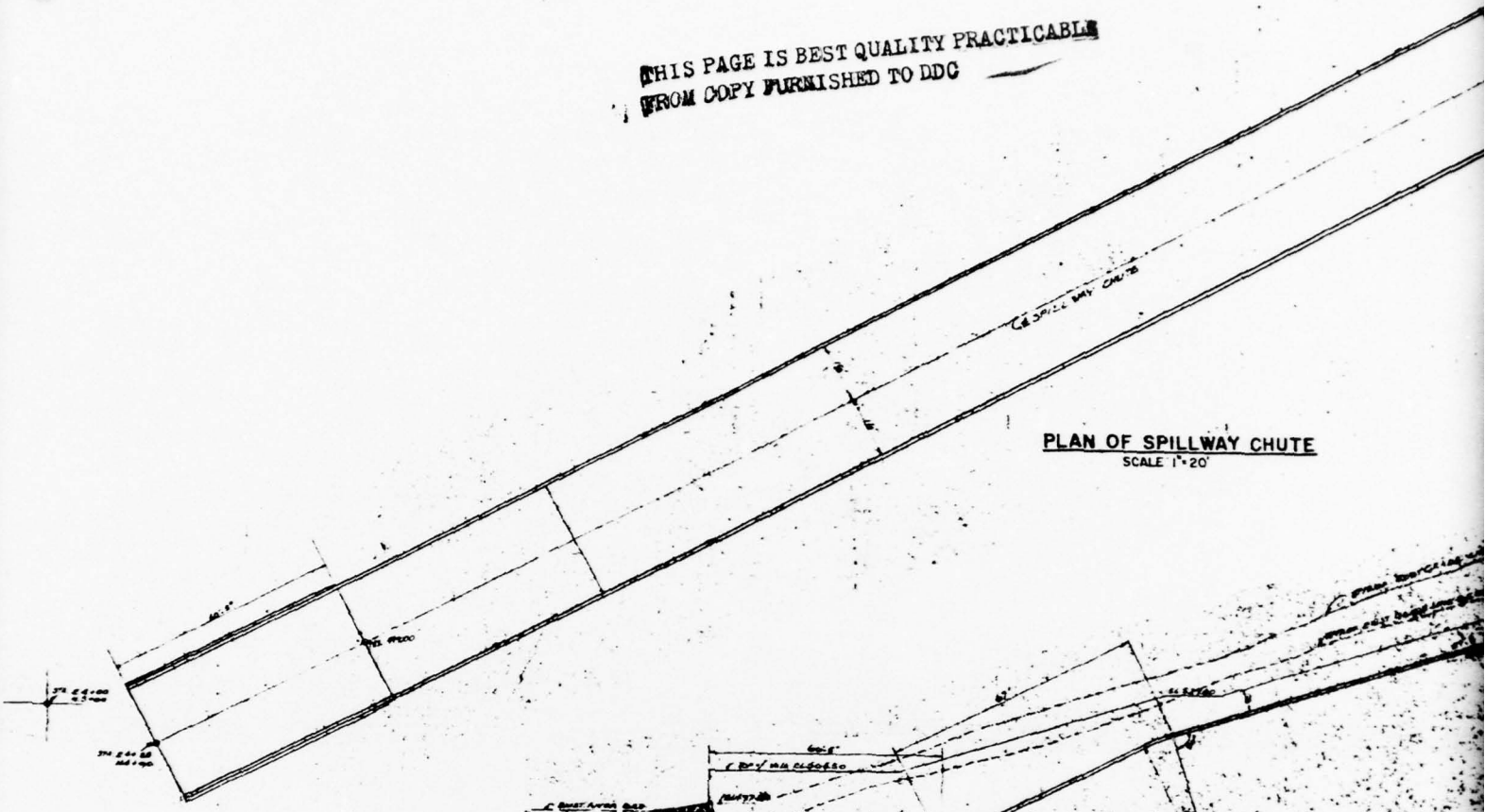
MP SUCTION LINE

WATER SUPPLY PIPELINE PROFILE
TROUT RUN RESERVOIR DAM

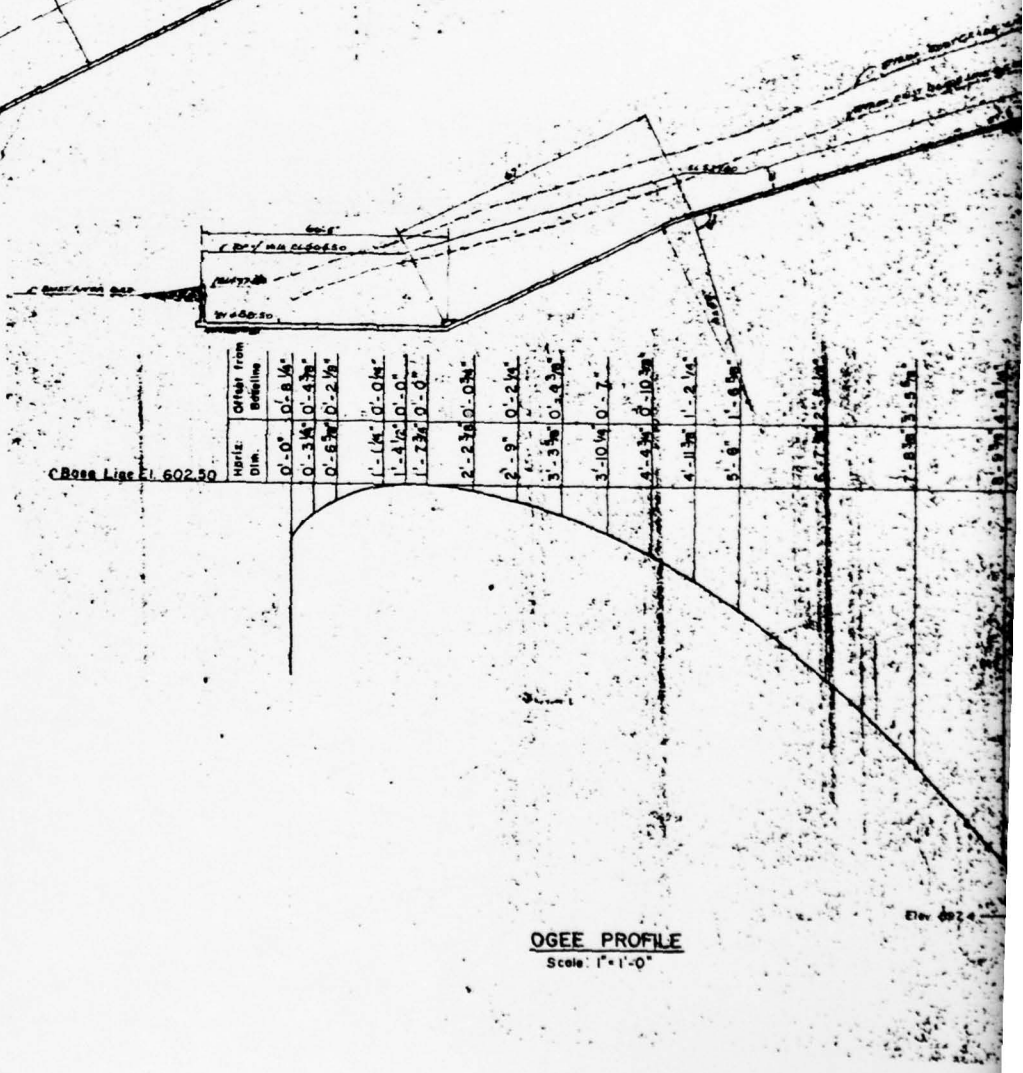
NAT. ID NO.PA.00797 BERKS COUNTY

DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226. SHEET NO.10 OF 26

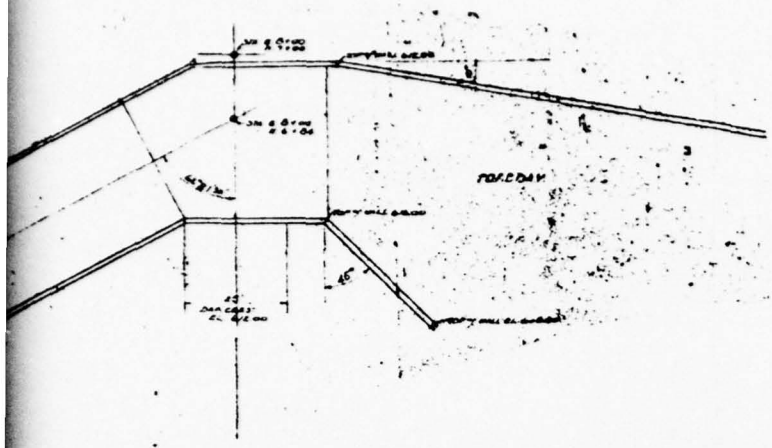
PLATE 7



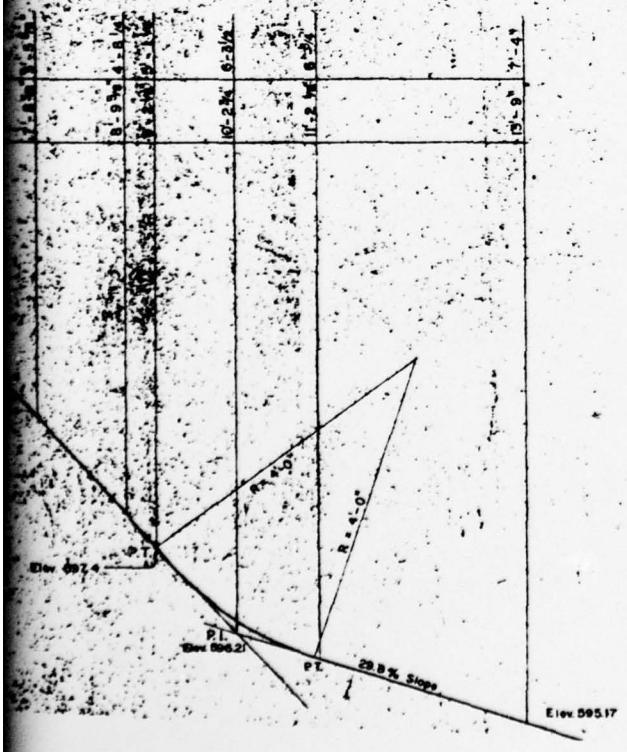
PLAN OF SPILLWAY CHUTE
SCALE 1"=20'



OGEE PROFILE
Scale: 1"=1'-0"



SPILLWAY & FOREBAY PROFILE
SCALE: 1" = 20'



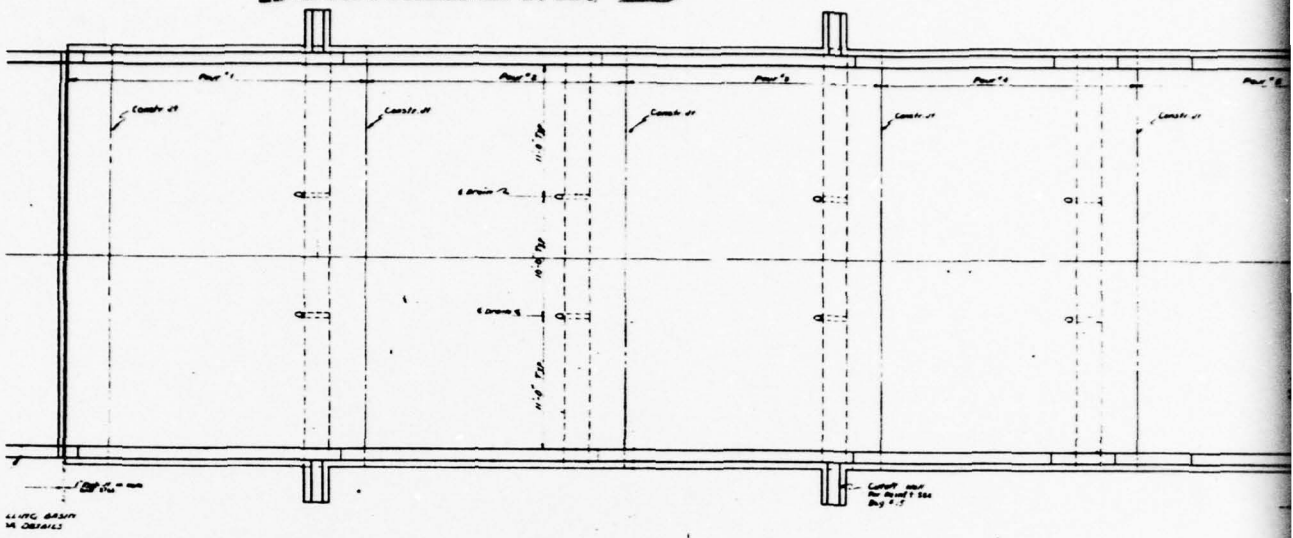
SPILLWAY PROFILE

TROUT RUN RESERVOIR DAM

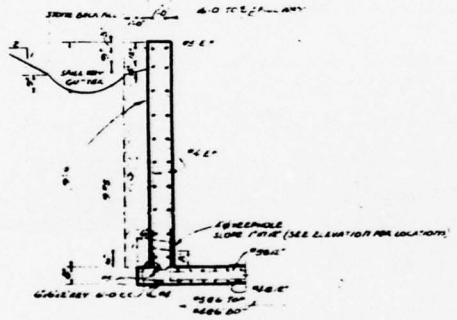
NAT. ID NO.PA.00797 BERKS COUNTY

DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226, SHEET NO.11 OF 26

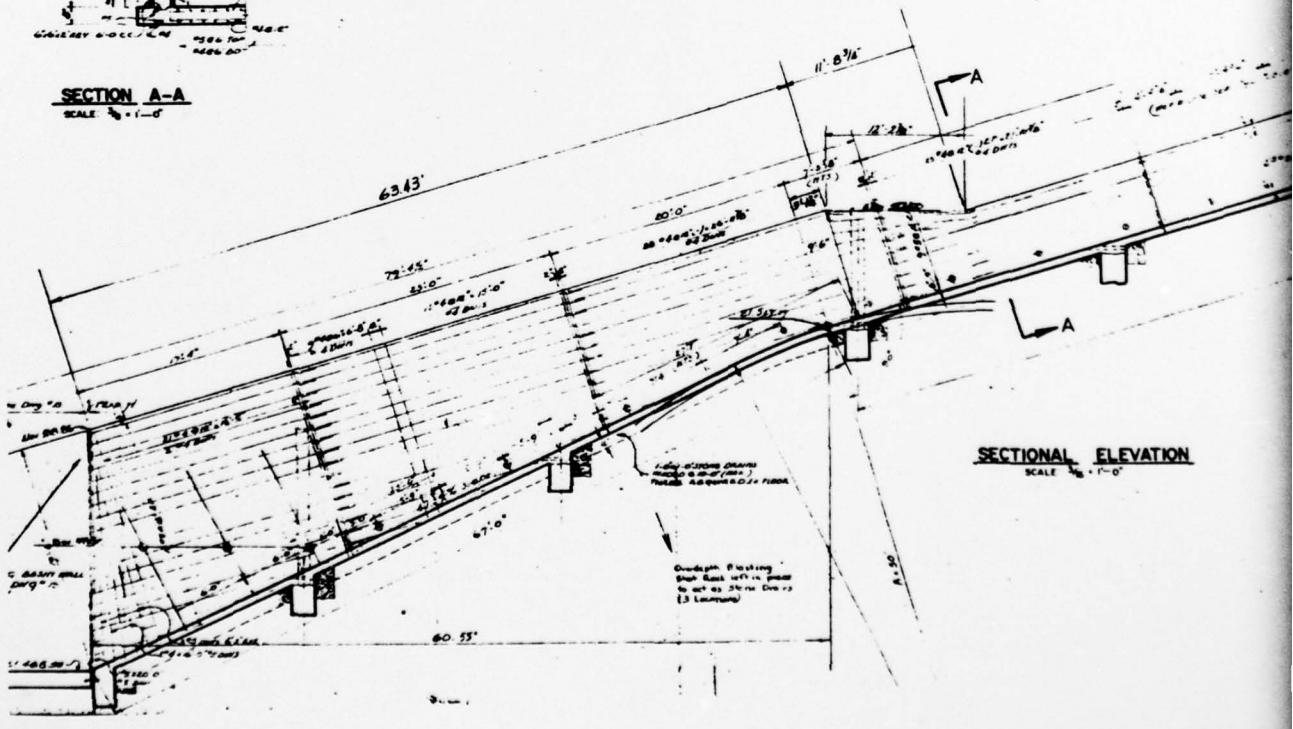
PLATE 8



PLAN
SCALE 1/16" = 1'-0"

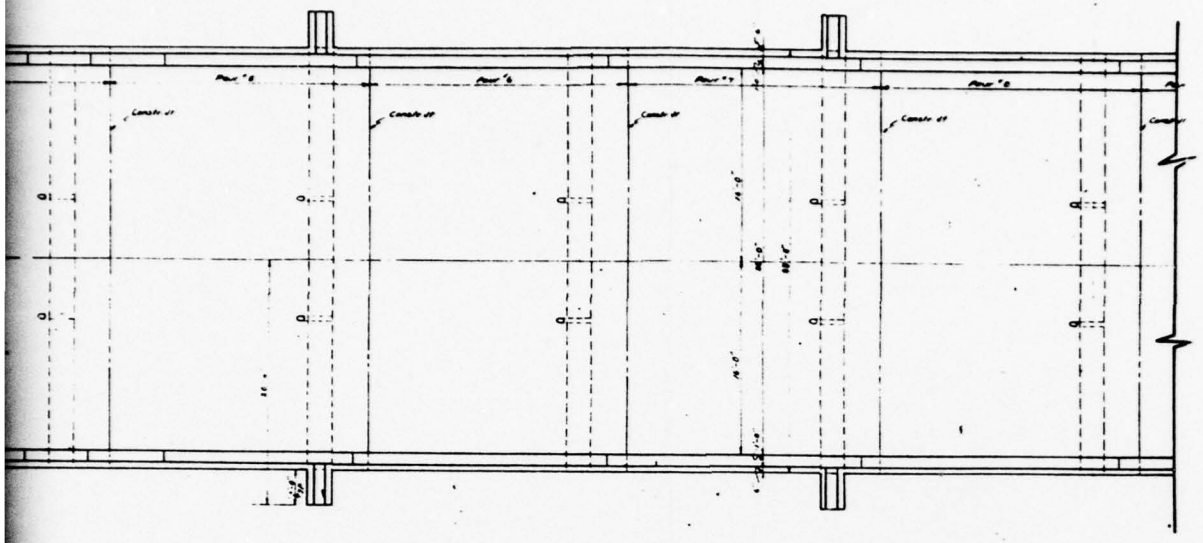


SECTION A-A
SCALE 3/8" = 1'-0"

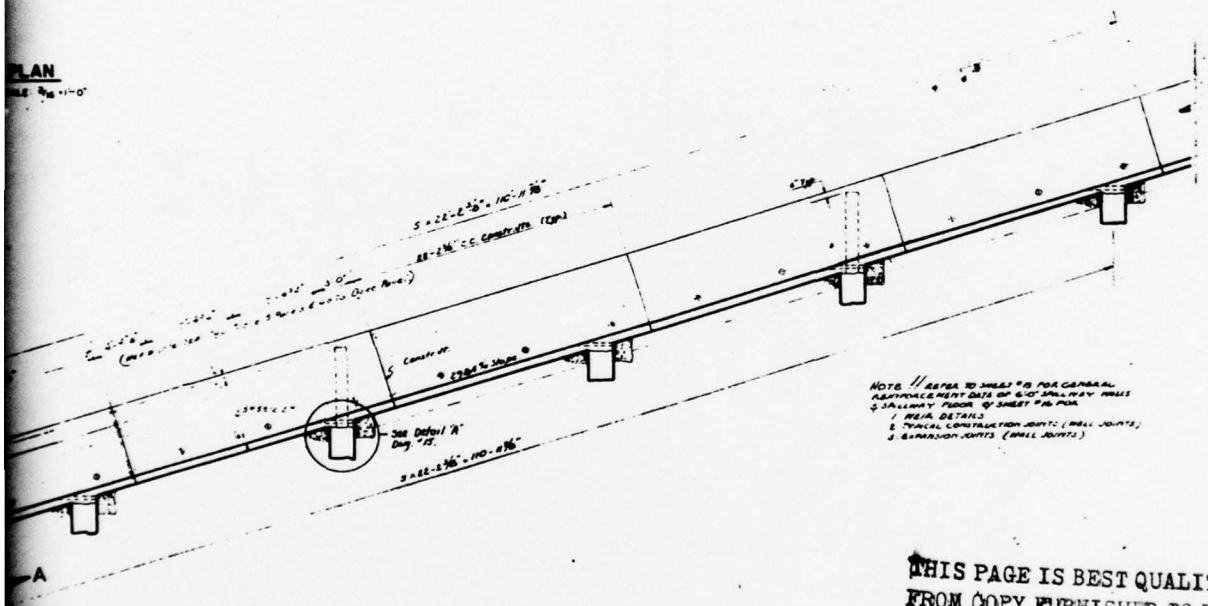


SECTIONAL ELEVATION
SCALE 1/8" = 1'-0"

2



PLAN



A

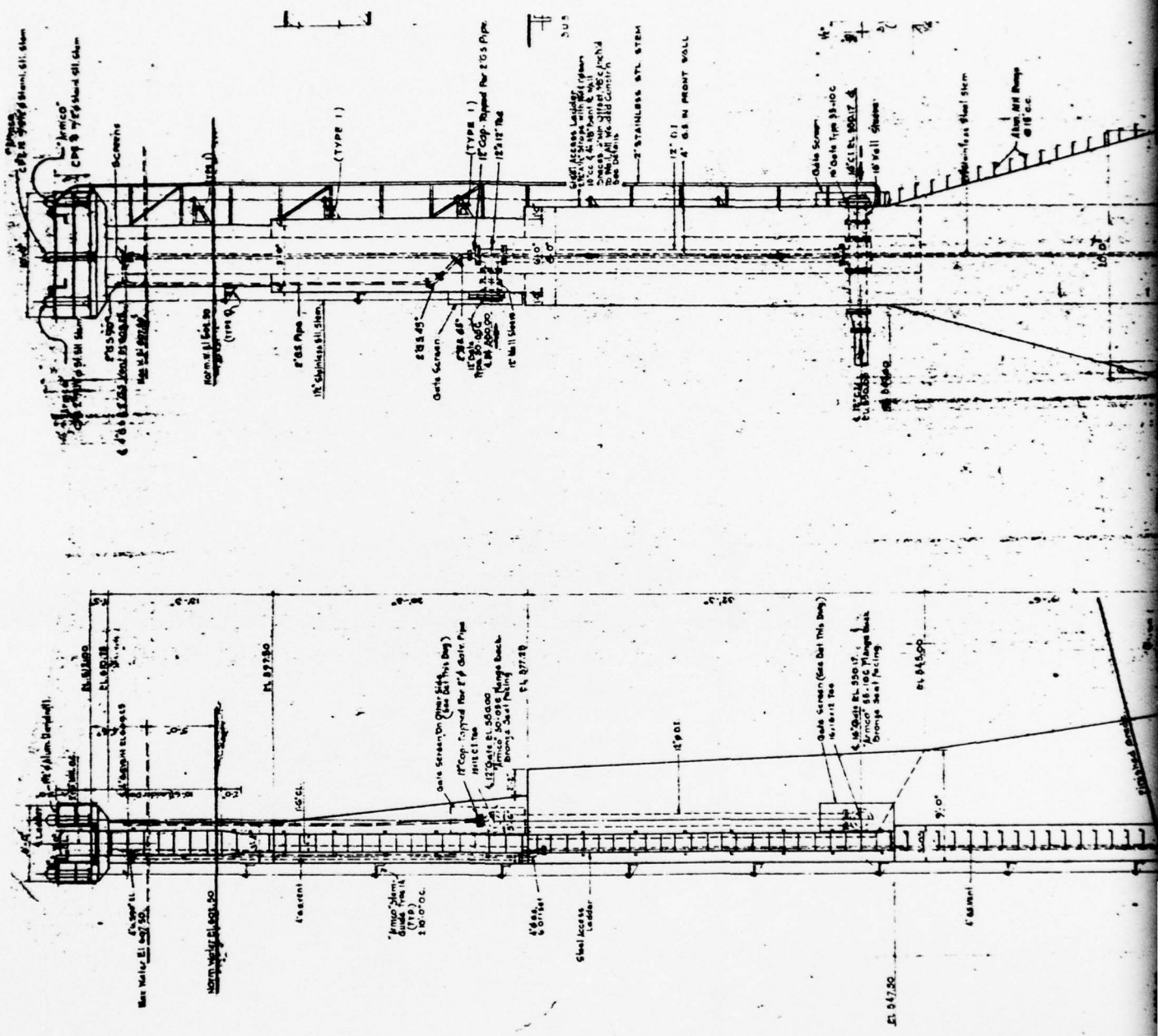
AL ELEVATION

DETAILS OF SPILLWAY CHUTE
TROUT RUN RESERVOIR DAM

NAT. ID NO.PA.00797 BERKS COUNTY

DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226, SHEET NO.14 OF 26

PLATE 9



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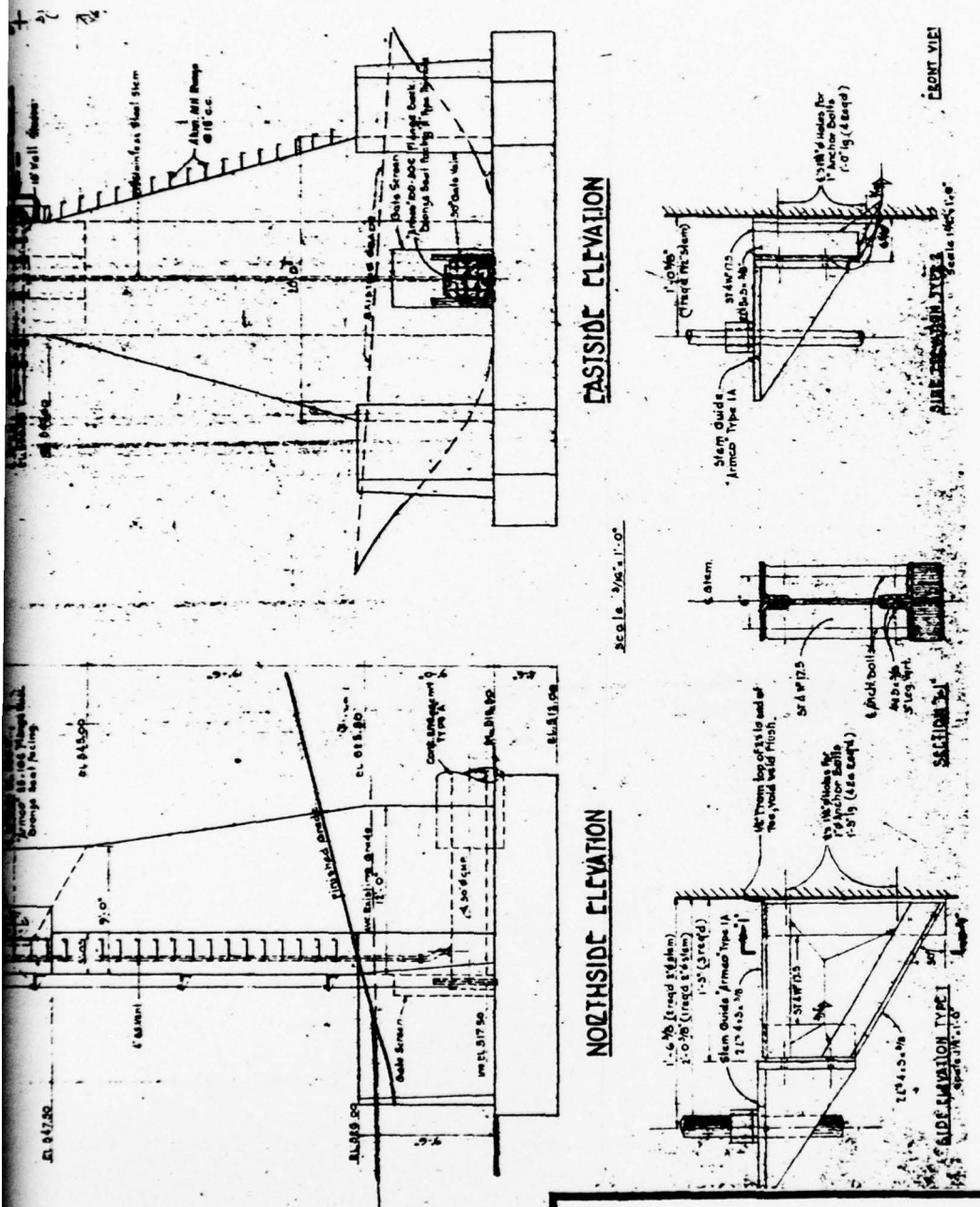


INTAKE TOWER DETAILS

TROUT RUN RESERVOIR DAM

NAT. ID NO.PA.00797 BERKS COUNTY

DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226, SHEET NO.19 OF 26

PLATE 10

SUDDEN DRAWDOWN

NORMAL FORCE: (N)

AREA = 2800 SF + 400 SF/SF + 4.17 = 11,266 CF

WEIGHT = 11,700 CF + 0.13 KIPS/CF

= 1470^

NET TANGENTIAL FORCE: (T)

AREA = 774 SF + 400 SF/SF + 10 FT = 3,174 CF

WEIGHT = 3100 CF + 0.131 KIPS/CF

= 406^

PORE WATER FORCE: (V_2)

AREA = 2660 SF + 400 SF/SF + 10 FT = 10,640 CF

FORCE = 10,640 CF + 0.0625 KIPS/CF

= 665^

LENGTH OF CIRCLE = 295'

C = 0.360 KIPS/FT

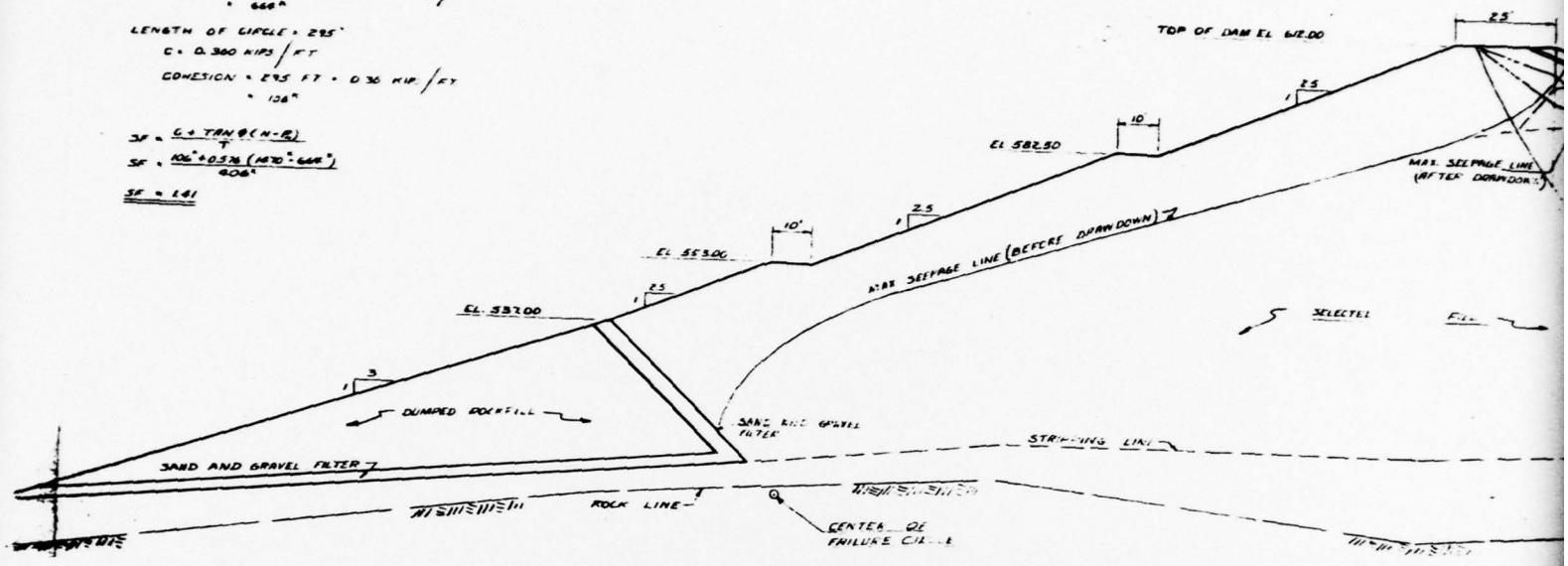
COHESION = 295 FT + 0.36 KIP/FT

= 106^

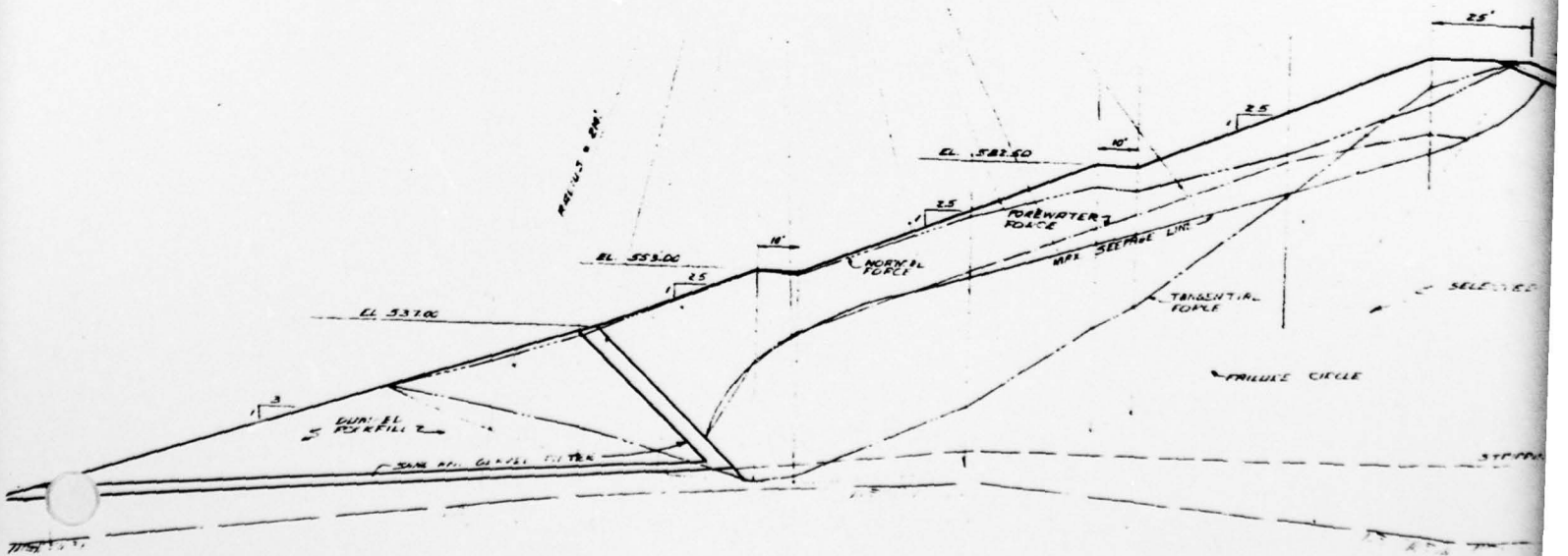
$$SF = \frac{C + \tan\phi (N - R)}{T}$$

$$SF = \frac{106^{\circ} + 0.576\,(1470^{\circ} - 665^{\circ})}{406^{\circ}}$$

SF = 1.61

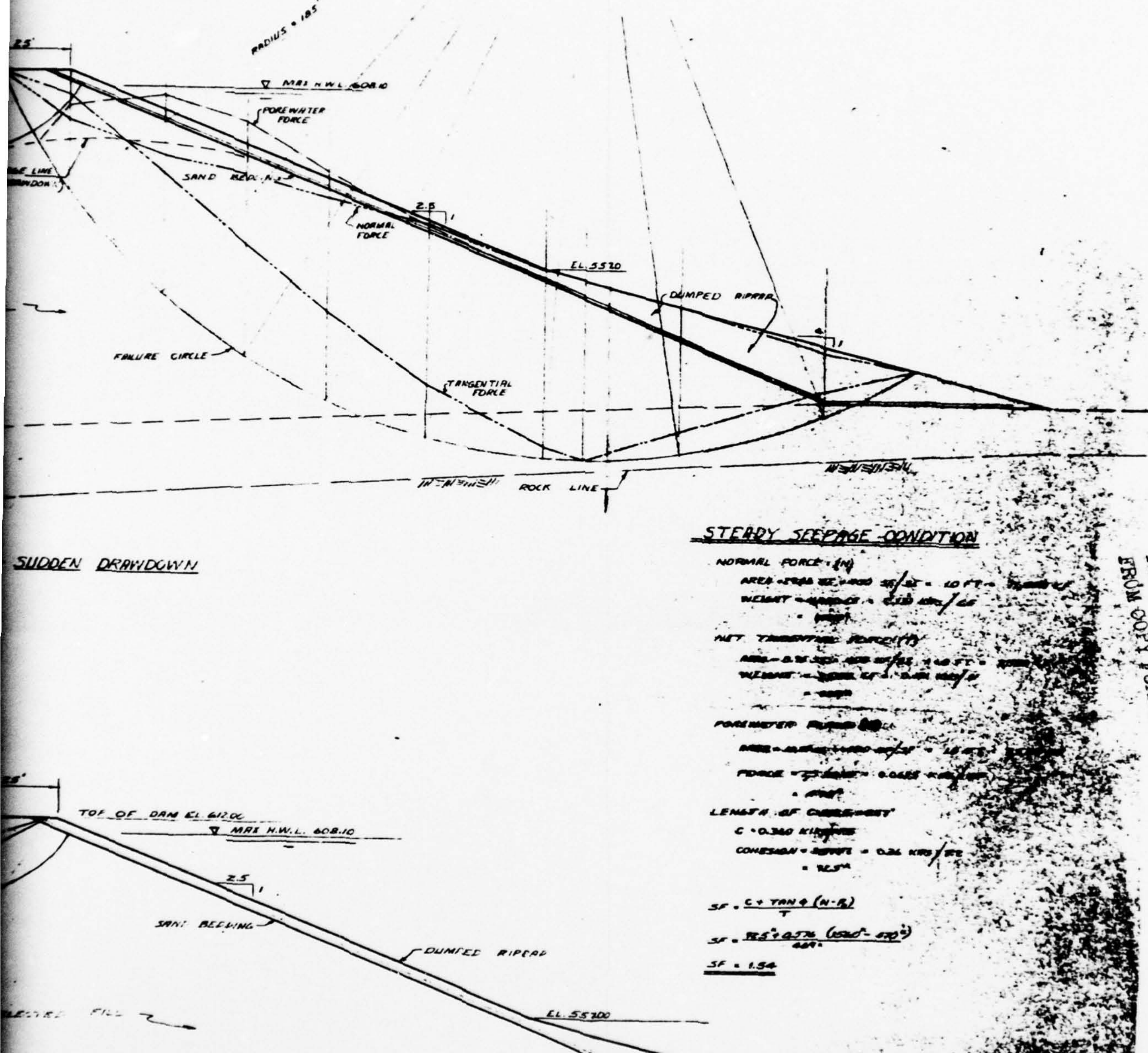


UPSTREAM SLOPE - SUDDEN



DOWNSTREAM SLOPE - STEADY

2



SUMMARY OF SLOPE STABILITY ANALYSIS

TROUT RUN RESERVOIR DAM

NAT. ID NO.PA.00797 BERKS COUNTY

DATA OBTAINED FROM GLACE & GLACE CONSULTING ENGINEERS, PHILA.,PA. FILE CODE 6226, SHEET NO. 1 OF 1

PLATE 11

APPENDIX

F

SITE GEOLOGY
TROUT RUN RESERVOIR

The Trout Run Reservoir is located at the boundary between the Great Valley section of the Valley and Ridge Physiographic Province and the Reading Prong section of the New England Upland Physiographic Province. The bedrock in the site area is reported to consist of the Cambro-Ordovician carbonates (undifferentiated) of the Great Valley, and the clastics of the Cambrian Hardyston Formation (see Plate F-1). These rocks are bordered to the north and east by the Precambrian gniesses of the Reading Prong, and to the south by a Triassic limestone conglomerate (Buckwalter, 1959). The Cambro-Ordovician carbonates and clastics are intensely deformed with both bedding and folding reported to be highly variable at the dam site (Buckwalter, 1959).

The dam is situated approximately perpendicular to the axis of a south plunging syncline with rock bedding striking from near east-west to northeast in the immediate dam site. Bedding planes dip into the valley of Trout Run (southerly) and locally assume a downstream direction of dip. During the 1978 inspection some bedding planes were observed to be open and spaced from less than one foot to greater than four feet. Rock jointing is well developed and consists of a east-northeast, northwest and near north-south and east-west striking sets. Joint dips are generally high angle (greater than 50°).

In the report prepared by Professor J.L. Dyson, 1963, reference was made to a fault zone crossing the dam foundation. This structure was evidenced by the abrupt change in rock attitudes measured during this field inspection. The fault zone is reportedly 100 feet wide, with a high angle northwesterly dip and lies beneath the spillway section of the dam.

Downstream seepage would not be unexpected due to the northeast striking joints, open bedding planes and the permeable material associated with faulted rock.

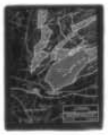
References:

1. *Buckwalter, T.V., 1962, The Precambrian Geology of the Reading 15' Quadrangle, Pennsylvania Geological Survey, 4th Series, Progress Report 161, 1:24,000.*

2. *Dyson, J.L., 1963, Report on the Geology of the Site of the Trout Run Impounding Dam Boyertown, Berks County, Pennsylvania, located in the "Environmental Impact Statement for the Trout Run Earthfill Dam", Docket No. D-72-277 CP, prepared by the Delaware River Basin Commission, May, 1973*

AD-A068 686 WOODWARD-CLYDE CONSULTANTS PLYMOUTH MEETING PA F/G 13/2
NATIONAL DAM INSPECTION PROGRAM. TROUT RUN DAM NATIONAL I. D. N--ETC(U)
SEP 78 DACW31-78-C-0048
UNCLASSIFIED NL

2 OF 2
AD A068686



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DATE FILMED
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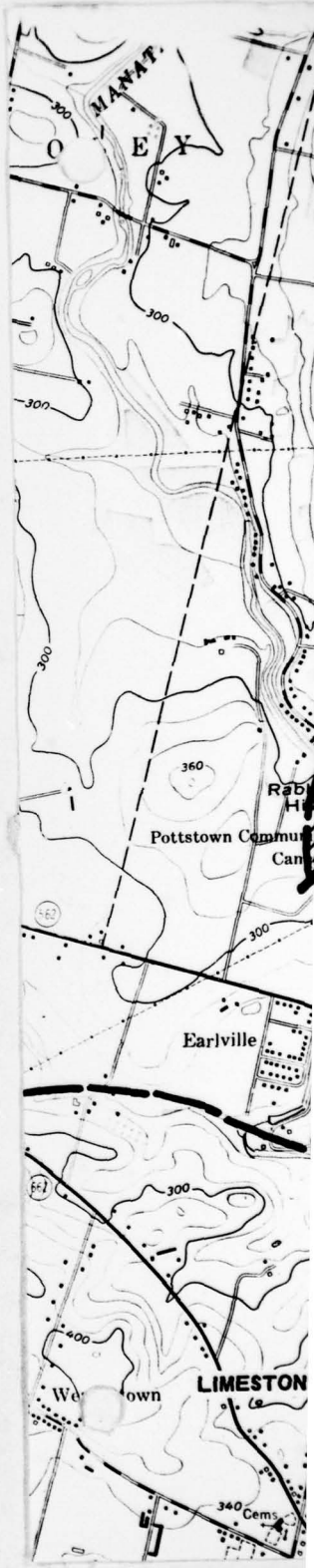
2 OF 2

068686


MANAT
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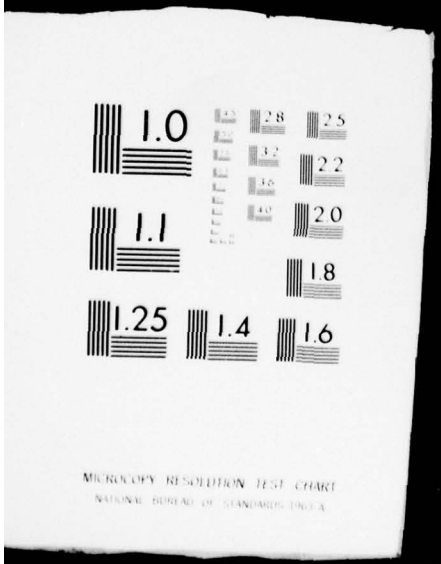
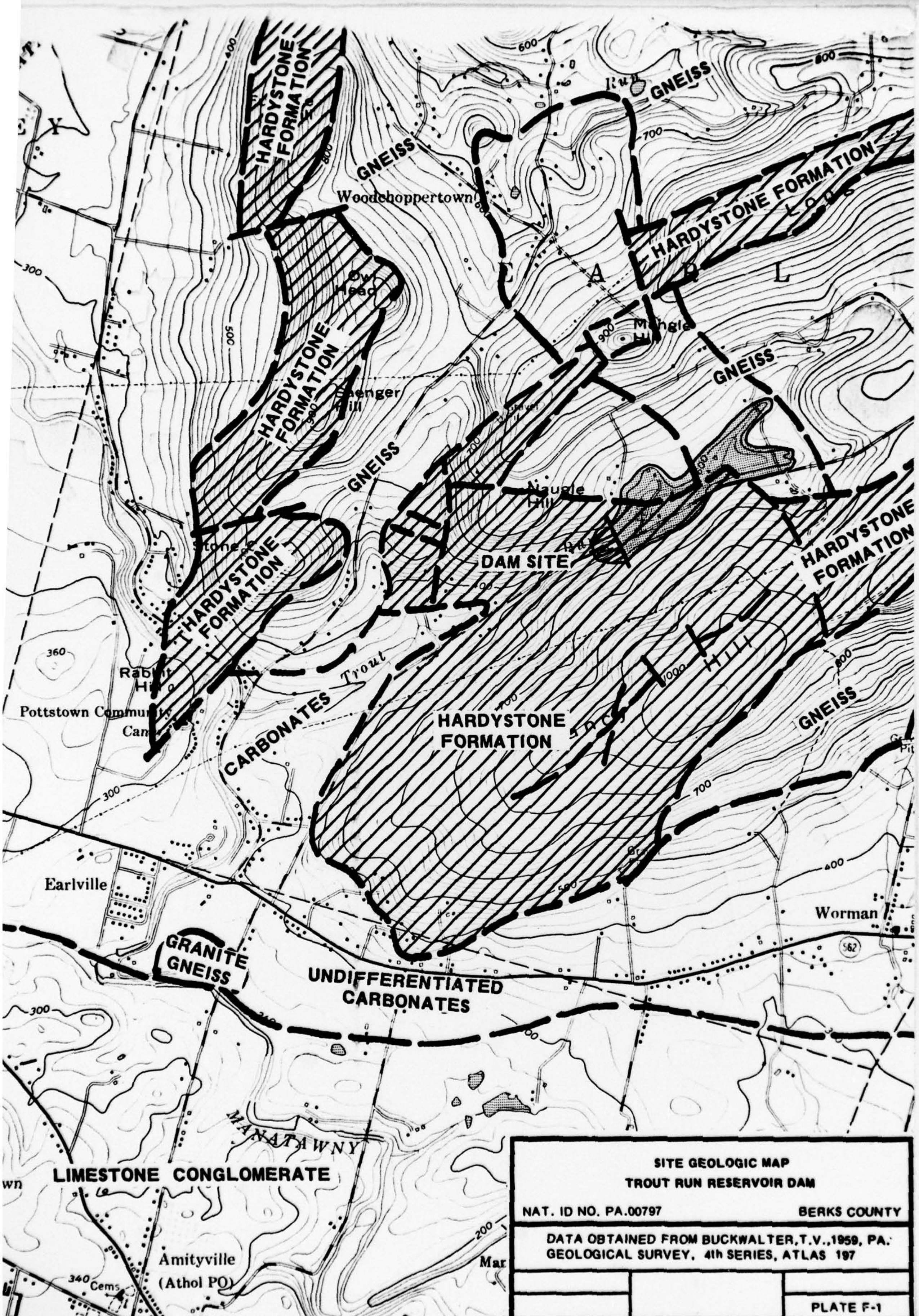
300
300
300
300
360
Pottstown Commun
Ca
Earlville
300
400
LIMESTON
340 Cems


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A



SITE GEOLOGIC MAP
TROUT RUN RESERVOIR DAM

NAT. ID NO. PA.00797 BERKS COUNTY

DATA OBTAINED FROM BUCKWALTER, T.V., 1959, PA. GEOLOGICAL SURVEY, 4th SERIES, ATLAS 197

PLATE F-1